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AGRICULTURAL WEATHER SERVICES

JOINT HEARINGS

BEFORE THE

SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY

AND THE

SUBCOMMITTEE ON DEPARTMENT OPERATIONS, RESEARCH, AND FOREIGN AGRICULTURE

OF THE

COMMITTEE ON AGRICULTURE HOUSE OF REPRESENTATIVES

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AGRICULTURAL WEATHER SERVICES

WEDNESDAY, JUNE 27, 1984

House of Representatives, Committee on Science and Technology, Subcommittee on Natural Resources, Agriculture Research and Environment, and Committee on Agriculture, Subcommittee on Department Operations, Research, and Foreign Agriculture,

Washington, DC.

The subcommittees met, pursuant to notice, at 9:40 a.m., in room 1302, Longworth House Office Building, Hon. George E. Brown, Jr. (chairman of the Agriculture subcommittee) presiding.

Present: Representatives Brown, Penny, Olin, Roberts, Gunderson, Evans of Iowa, Franklin, and Lewis of Florida.

Also present: Representative de la Garza, ex officio.

Staff present: Bob Bor, chief counsel; John Hogan, minority counsel; Christine Abram, staff assistant; William Stiles, subcommittee staff consultant (for the Agriculture Subcommittee); Jack Fellows and Ronald Rahn, congressional science fellows; Mary Beth McJury, minority technical consultant (for the Science and Technology Subcommittee); and Marty Ralston, staff assistant (for the Science and Technology Subcommittee).

Mr. **Brown**. The subcommittees will come to order.

We welcome everyone here this morning. This is a joint hearing of two subcommittees, the Subcommittee on Department Operations, Research and Foreign Agriculture of the Agriculture Committee; and the Natural Resources, Agriculture Research and Environment Subcommittee of the Committee on Science and Technology.

I have a brief opening statement, and if you will bear with me, we will go through that.

We are pleased to welcome a number of distinguished Federal, State, academic and private sector representatives and individuals who will present their views on a national agricultural weather operation.

Under the leadership of my colleague, Mr. Scheuer, the need for specialized agriculture weather information was well documented in a previous subcommittee hearing in Florida last year. The testimony suggested that the benefits of this program greatly outweighed its very small cost, which is about $1.5 million per year.

Despite the evidence presented at that hearing, the administration continues to propose the elimination of the present agriculture weather program. Each year for the past several years Congress has restored these funds, but the uncertainty of funding jeopardizes the quality of the program and weakens the communication network that has developed between the Federal, State, and local levels.

Because of their respective jurisdictional responsibilities, we have brought our subcommittees together in these two major committees to further examine this issue. The Science and Technology Subcommittee oversees the operation of the National Weather Services, which currently develops specialized agricultural weather services. Our subcommittee here in Agriculture is responsible for the Department's Extension Service that has historically disseminated information and research results to the farmer.

The unpredictability of weather continues to make farming a tenuous profession. In addition, farmers face increasingly high costs of capital, labor, energy, water, fertilizers and pesticides. Good quality and timely agricultural weather data can minimize some of these costs through improved resource management, but the question remains, how much will it cost and who will pay for this information?

The small farmer may not be able to pay for the tailored, value-added weather information that is needed. Yet if this information is not available, eventually the consumer bears the cost of weather-related crop losses.

These 2 days of hearings will explore some very exciting new technologies, cooperative efforts, and policy proposals that are constantly being developed. Today we will hear from weather users and private sector weather producers. Continuing on tomorrow, representatives from the USDA and the National Weather Services will review our present agricultural weather operations.

A proposed plan for better Federal, State, and local agriculture weather coordination will be presented, and we will hear about new automated weather collection technologies and State initiatives. It is my hope that we can take this cpportunity to move toward a new coordinated agricultural weather operation by borrowing from and capitalizing on these excellent initiatives that have already been started.

Now I would like to call on the distinguished chairman of our full Committee on Agriculture, Mr. de la Garza of Texas, for any opening comments that he might have.

Mr. **DE LA GARZA**. Thank you very much, Mr. Chairman, and I welcome members of the Science and Technology Committee, including yourself who shares service in those two committees.

Mr. Chairman, this is indeed a very critical and very important factor in the United States as far as our being able to feed and clothe our people and what we have available for export, which is the only positive in our balance of trade so far.

The expertise from the Department and, hopefully, other areas of weather involvement—NASA and so on—will be here, but I am very eager to hear from the private sector. This is my area of concern.

I know there has been much mention of disposing of satellites and making this a private sector endeavor. From a very parochial interest for agriculture and from my area, I cannot see where it would work, because you need a comprehensive, worldwide national gathering system, so if you went into competing factors, private companies, one would be local, one would be State, and another one could be regional; and the available data, where would it come from? So you would have chaos.

This needs to be a national program. I do not see that it is one that can be handled entirely with the private sector because the expertise up to now is not there. Would that we could control the weather, but that we cannot do. So the next resource we have available is the expertise to observe the weather patterns. Some people call it predicting; we know it is not that, but rather to make available weather patterns and possibilities.

As you know, in agriculture, millions of dollars, millions of jobs, and millions of people who use the end product are impacted. If you have the frost time on some citrus fruit in my area, if you miss it by an hour, you could miss several hundred thousands of dollars of money.

The dew point for your spraying—all of the areas that impact on agriculture—whether it will rain, in what area, at what time—we have flooding throughout the Midwest—all of that is the impact of weather. and how best the users of this information in order to protect, sandbag a river before a flood, when not to use the insecticide or pesticide or whatever, a chemical that would be rained off your plants if the rain comes—it is a very highly technical area, and the expertise, Mr. Chairman, is there in the governmental areas. I think that this is the area where it should remain.

Now, as to availability of resources to pay or to contribute, I hope that we get from our witnesses some assurance of their interest in that respect. But I think, Mr. Chairman, that we would have no more important hearings that these that you are having during the course of this year or into the next year, because all of the—when was it, just the day before yesterday, they had the commemoration of either the birthday or the ascension to the throne of the King of Spain, and I went by the Spanish Embassy to pay my respects, and there I ran across the Agricultural Councilor at the Spanish Embassy. He was with a group of friends from the Embassy, and he introduced me as, "This is the most powerful man in Congress; he is chairman of the most powerful committee in Congress."

So I nodded in a positive manner, somewhat embarrassed, but then his explanation was,

> This is a great and fantastic country. You know they provide food for all of their people and enough to spare for the rest of the world. Nobody else can do this, and this is solely done through the agricultural sector.

Well, I think he said it correctly, and not because of me, personally, but he made a statement of fact. And that can only be in great part due to the very valuable service that we in the agricultural sector receive from the weather information. I think that this is very, very important. Forgive me for using the personal mention, but I do it only for the fact that he used.

So I commend you, Mr. Chairman, I do hope that the witnesses, both in the private sector and the Department, will have constructive suggestions as to how we can better the system. I doubt that we can better the expertise, or perhaps we still can, using outer space; perhaps we still can.

Just one other personal mention. In my area we have a local television station that, of course, spends 90 percent of the time on the local weather; 5 percent of the time on the State weather; and a very narrow glimpse at the national weather.

Well, up here I have available to me that national pattern daily, and I can follow the lows and I can follow the fronts, and I am getting to be some kind of phenomenon in my area that I can predict rain or I can predict a northern coming in, and they don't know that I just saw it for the last 2 or 3 days on the national pattern here, and I have been following as it is coming either from the Pacific or from the Rockies. I have been following it all week, and when I get home Friday or Saturday and I say, "By Monday we should have some rain," they think I am the greatest. And all I am doing is availing myself of the national and world pattern that is available to us here and not at home, where they only do the localized weather.

So with that, Mr. Chairman, I commend you for these hearings, and I hope that they will give us constructive information that we may try to enhance and, if possible, convince the administration and others that it is a national need; it is a critical national security need that we keep agriculture healthy and productive, and I think that this impacts on what you will be speaking about here in the next couple of days as to the impact that weather has, and what the ability to disseminate information as to weather patterns means to our agricultural use.

Thank you, Mr. Chairman.

Mr. BROWN. Thank you very much, Mr. Chairman.

At this point I would like to insert into the record a statement by Hon. Pat Roberts, of Kansas, the ranking minority member of the Agriculture Committee, and then I would like to call on Mr. Lewis for a statement representing the Science and Technology Committee.

[See appendix p. 347]

Mr. LEWIS. Thank you, Mr. Chairman.

I am pleased that the Natural Resources Subcommittee has teamed up with the Agriculture Committee to review and evaluate our agricultural weather service. This is a low-cost but high-benefit program that I have strongly supported in the past and will continue to support.

Last year I had the privilege of hosting a subcommittee hearing in my district on this subject, where members heard first-hand from Florida fruit and vegetable growers how critical this program is to their country and industry. The accurate, around-the-clock forecasts are absolutely essential, particularly during the winter months, when much of the Nation's fresh fruits and vegetables come from Florida.

For those who don't know, my district is the vegetable capital of the world during January, February, and March of every year.

The availability of frost warnings for Florida growers can mean the difference in millions of dollars for producers and consumers.

This morning I am particularly pleased to welcome to Washington and to this hearing Al French from the Florida Farm Bureau. He knows well the potential for a full-scale disaster on the part of agriculture if the agricultural weather services and the fruit frost warning program were discontinued and no viable alternative put in place.

Again, Mr. Chairman, I am delighted that the two committees are once more giving this important issue their full consideration, and I look forward to hearing from the expert witnesses we have before us.

Mr. **Brown**. Thank you very much, Mr. Lewis.

I would like to call up our first panel of witnesses: Mr. Al French, Mr. Richard Flowers, Ms. Millie Godfrey Harner, and Mr. Paul LaVine. If they would take their seats up at the table, we can get started.

While they are doing that, Mr. Lewis, I would like to take the pleasure of introducing Ms. Millie Godfrey Harner, general manager of Imperial Cotton Products, from Imperial County in California, which is the vegetable capital of the world from April on through December. [Laughter.]

That is where you leave off.

I am pleased that we do have such an able representative from California; in fact, we have two representatives from California here, and I am sure that was entirely accidental, and we are looking forward to their testimony this morning.

Mr. French, I think you are the leadoff, so if you would proceed with your statement, we would appreciate it. The full text of your statement will be in the record. If you should leave anything out, it will still be there. Then we will take each of the other witnesses in turn.

STATEMENT OF ALLISON T. FRENCH, ASSISTANT TO THE PRESIDENT, FLORIDA FARM BUREAU FEDERATION

Mr. **French**. Thank you, Mr. Chairman.

My name is Al French. I am director of public affairs for the Florida Farm Bureau Federation.

Florida Farm Bureau is our State's oldest and largest general farm organization, with a membership of over 70,000 families. The great majority of farmers and ranchers in Florida are members of our organization, and they produce about 260 commodities on a commercial basis.

As producers of winter fruits and vegetables, Florida farmers find the National Weather Services station in our State to be vital. Its value has been demonstrated over and over again as frost and freeze threatened Florida's fruit and vegetable crops.

The National Weather Services benefits not only farmers but the one in four jobs in our State which are related to agriculture, the millions of consumers of Florida produce, and the Federal Treasury. The National Weather Services does not cost the Federal Government; it pays.

Before I discuss the necessity of maintaining this vital service, let me point out that we wholeheartedly support reduced Government spending, balanced budgets and relief for the beleaguered taxpayer. We supported the administration's reduction in the USDA budget as well as holding the line on increased commodity price support programs.

We supported the 50-percent reduction in staff of the agricultural weather program in our State in 1983. We have consistently supported cutbacks when and where necessary in order to reduce Federal spending and to trim the fat from the Federal budget. I say this to demonstrate that we are not hypocritical in our request for retention of the Agricultural Weather Service, nor do we merely advocate cutbacks for others.

Agriculture is a very large industry in Florida which is highly subject to the vicissitudes of weather. We have experienced killing freezes during 3 of the past 4 years. Freeze losses to farmers during the past season were in excess of $1 billion. Certainly our losses would have been far greater had it not been for the Federal Frost Warning Service in our State.

Annual farm cash receipts in Florida total more than $4 billion. Coupled with related processing, packaging, and transportation services, our agricultural industry contributes over $12 billion each year to our State's economy. Florida ranks 11th in the Nation in total farm cash receipts. We provide jobs to 112,000 hired farm workers and several times that in related enterprises. Close to one-fourth of Florida's work force is directly or indirectly employed in agriculture.

Ninety-five percent of the Nation's frozen orange concentrate is grown and processed in Florida.

Florida ranks No. 1 in the production of citrus, tomatoes, sugarcane, sweet corn, cabbage, snap beans, cucumbers, eggplant, escarole, green peppers, foliage plants, watermelons, honey, and quarter horses. All but the last three are winter crops, which are highly susceptible to freeze damage.

Florida ranks No. 2 in many other fruit and vegetable crops.

While we are very proud of our contribution, these facts are not presented in order to boast, but rather to indicate the magnitude and potential impact upon a very large industry which is dependent upon timely and accurate weather services.

Weather services have an even greater future role in Florida's vast farm and agribusiness structure.

The agriculture weather program plays a key role in the protection of Florida's 17 million acres of forests by providing a constant stream of information regarding temperature, humidity, and other weather conditions which help gauge the danger of fire and assist the Forest Service and the Florida Division of Forestry to make necessary preparations during danger periods. Continuous weather mapping enables our foresters to keep tabs on insect activity and the timing of pest management practices.

The National Weather Services station in Ruskin, FL, is the ground link to gather satellite weather information used by the University of Florida's Institute of Food and Agricultural Sciences in the development of detailed electronic weather maps. This system will eventually allow transmission of agricultural national weather maps which can be displayed on home television sets. The Weather Services is a necessary link to connect ground station weather information with satellite in order to achieve this capability.

The Agriculture Weather Service has the capability, experience and equipment necessary to help farmers minimize losses during freeze damage. Reports are issued every 2 hours during severe weather periods. The information on projected low temperatures, timing, duration, inversion levels, wind, cloud cover, et cetera, enable farmers to make provisions for the protection of their crops. This protection consists of irrigation, wind machines, and petroleum fuel heaters.

By delaying such protection until the critical time, farmers can effect great savings in water, energy, and expense. By saving a crop which would otherwise be lost, the farmer can provide lower cost food for the consumer, avoid unemployment and its attendent cost to the Federal Treasury, and protect the profits which generate Federal revenues.

As a result of timely weather information, farmers can save millions of dollars in a single night. Fred Crosby, chief meteorologist at the weather station in Ruskin, FL, found, "In the 1977 freeze, the information we provided saved citrus growers in Lake and Orange Counties alone between $5 million and $7 million." Now, Lake and Orange Counties in Florida are only 2 of 25 large citrus-producing counties.

If you assume a marginal income tax rate of 30 percent, the additional Federal revenues from these two counties alone would pay the entire cost of the Nation's Agricultural Weather Service for over a year.

The Agricultural Weather Service also provides valuable information for agricultural management practices. Soil temperatures, wind speed and velocity, evaporation rates, vegetative wetting, and moisture measurement are all factors to determine optimum planting times.

Analysis of wind speed and direction are important for agricultural aviation to minimize the application of costly agricultural chemicals. Moreover, an unexpected rainstorm following a pesticide application can result in an economic loss as well as the introduction of pesticides into the soil.

Continued development of integrated pest management holds great promise for lower good production costs and improved environmental quality. Agricultural weather data is an important element of such programs, and it is desirable for farmers, consumers, and the public at large that this information continue to be available.

A strong, healthy agriculture is not only in the interest of farmers. The production of food and fiber is in the interest of every person who likes clothing, shelter, and three square meals a day. Agriculture is our Nation's largest industry; it is our Nation's largest employer; it is our Nation's largest contributor to the international balance of trade.

Because of our efficient agricultural industry, Americans enjoy the largest quantity and quality of wholesome, fresh food at the lowest cost of any country in the world. Only 16 percent of disposable income is used for the purchase of food in this country.

Our agricultural system allows 97 percent of our population to pursue vocations of their own interest without having to worry about where their food is coming from.

The transfer of Government programs and activities to the private sector is a concept of considerable merit, and the feasibility of this should be continually explored. Frequently, the result is greater efficiency, superior service or product, and a welcome reduction in Federal spending. If it could be shown that such efficiency could be attained by privatization of the Agricultural Weather Service, it should be implemented without delay.

However, given the complexity and diversity of our agricultural industry, no one has been able to design a system which even approaches the efficiency of our present Agricultural Weather Service. Given the very low cost of this service—only $1.5 million a year—it appears very unlikely that a feasible private sector approach will be devised in the foreseeable future.

The Agricultural Weather Service is one of the few programs that returns a profit to the Federal Treasury in the form of increased tax revenues and reduced spending. If all Government programs operated on this basis, we would enjoy huge budget surpluses rather than the current deficits. Clearly, there is no merit or advantage to the discontinuance of this vital service.

In summary, the current agricultural weather program is vital to our Nation's largest industry; it provides significant benefits to consumers; it carries important environmental considerations and is a credit in the Nation's balance sheet.

This program has generated far more than its cost in Federal revenues. It has saved the Government hundreds of millions by keeping farmers in business, maintaining farm employment, providing consumers with quantities of wholesome and inexpensive food. There is simply no effective substitute for this service available in the private sector.

We respectfully request that you do everything possible to continue this important service and maintain it at an adequate funding level. Thank you.

[The prepared statement of Mr. French follows:]

STATEMENT ON AGRICULTURAL WEATHER SERVICES

Presented to

THE HOUSE AGRICULTURE COMMMITTEE'S

SUBCOMMITTEE ON DEPARTMENT OPERATIONS,

RESEARCH, AND FOREIGN AGRICULTURE

By Allison T. French

Florida Farm Bureau Federation

FLORIDA FARM BUREAU IS OUR STATE'S OLDEST AND LARGEST GENERAL FARM ORGANIZATION WITH A MEMBERSHIP OF OVER 70,000 FAMILIES. THE GREAT MAJORITY OF FARMERS AND RANCHERS IN FLORIDA ARE MEMBERS OF OUR ORGANIZATION AND THEY PRODUCE ABOUT 260 COMMODITIES ON A COMMERCIAL BASIS.

AS PRODUCERS OF WINTER FRUITS AND VEGETABLES, FLORIDA FARMERS FIND THE NATIONAL WEATHER SERVICES STATION IN OUR STATE TO BE VITAL. ITS VALUE HAS BEEN DEMONSTRATED AGAIN AND AGAIN AS FROST AND FREEZE THREATENED FLORIDA'S FRUIT AND VEGETABLE CROPS. THE NATIONAL WEATHER SERVICE BENEFITS NOT ONLY FARMERS, BUT THE ONE IN FOUR JOBS IN OUR STATE RELATED TO AGRICULTURE, THE MILLIONS OF CONSUMERS OF FLORIDA PRODUCE, AND THE FEDERAL TREASURY. THE NATIONAL WEATHER SERVICE DOES NOT COST THE FEDERAL GOVERNMENT, IT PAYS!

BEFORE I DISCUSS THE NECESSITY OF MAINTAINING THIS VITAL SERVICE, LET ME POINT OUT THAT WE WHOLEHEARTEDLY SUPPORT REDUCED GOVERNMENT SPENDING, BALANCED BUDGETS, AND RELIEF FOR THE BELEAGUERED TAXPAYER.

WE SUPPORTED THE ADMINISTRATION'S REDUCTION IN THE U.S.D.A. BUDGET AS WELL AS HOLDING THE LINE ON INCREASED COMMODITY PRICE SUPPORT PROGRAMS.

WE SUPPORTED THE 50% REDUCTION IN STAFF OF THE AGRICULTURAL WEATHER PROGRAM IN OUR STATE IN 1983. WE HAVE CONSISTENTLY SUPPORTED CUTBACKS WHEN AND WHERE NECESSARY IN ORDER TO REDUCE FEDERAL SPENDING AND TO TRIM FAT FROM THE FEDERAL BUDGET. I SAY THIS TO DEMONSTRATE THAT WE ARE NOT HYPOCRITICAL IN OUR REQUEST FOR RETENTION OF THE AGRICULTURE WEATHER SERVICE, NOR DO WE MERELY ADVOCATE CUTBACKS FOR OTHERS.

AGRICULTURE IS A VERY LARGE INDUSTRY IN FLORIDA WHICH IS HIGHLY SUBJECT TO THE VICISSITUDES OF WEATHER. WE HAVE EXPERIENCED KILLING FREEZES DURING THREE OF THE PAST FOUR YEARS. FREEZE LOSSES TO FARMERS DURING THE PAST SEASON WERE IN EXCESS OF $1 BILLION. CERTAINLY, OUR LOSSES WOULD HAVE BEEN FAR GREATER HAD IT NOT BEEN FOR THE FEDERAL FROST WARNING SERVICE IN OUR STATE.

ANNUAL FARM CASH RECEIPTS IN FLORIDA TOTAL MORE THAN $4 BILLION. COUPLED WITH RELATED PROCESSING, PACKAGING, AND TRANSPORTATION SERVICES, OUR AGRICULTURAL INDUSTRY CONTRIBUTES OVER $12 EACH YEAR TO OUR STATE'S ECONOMY. FLORIDA RANKS ELEVENTH IN THE NATION IN TOTAL FARM CASH RECEIPTS. WE PROVIDE JOBS TO 112,000 HIRED FARM WORKERS AND SEVERAL TIMES THAT IN RELATED ENTERPRISES. CLOSE TO ONE FOURTH OF FLORIDA'S WORK FORCE IS DIRECTLY OR INDIRECTLY EMPLOYED BY AGRICULTURE.

FARM FACTS

-95% OF THE NATION'S FROZEN ORANGE CONCENTRATE IS GROWN AND PROCESSED IN FLORIDA.

-FLORIDA RANKS NUMBER ONE IN THE PRODUCTION OF CITRUS, TOMATOES, SUGARCANE, SWEET CORN, CABBAGE, SNAP BEANS, CUCUMBERS, EGGPLANT, ESCAROLE, GREEN PEPPERS, FOLIAGE PLANTS, WATERMELONS, HONEY, AND QUARTER HORSES. ALL BUT THE LAST THREE ARE WINTER CROPS WHICH ARE HIGHLY SUSCEPTIBLE TO FREEZE DAMAGE.

-FLORIDA RANKS NUMBER TWO IN MANY OTHER FRUIT AND VEGETABLE CROPS.

WHILE WE ARE PROUD OF OUR CONTRIBUTION, THESE FACTS ARE NOT PRESENTED IN ORDER TO BOAST, BUT RATHER TO INDICATE THE MAGNITUDE AND POTENTIAL IMPACT UPON A VERY LARGE INDUSTRY WHICH IS DEPENDENT UPON TIMELY, ACCURATE WEATHER SERVICES.

WEATHER SERVICES HAS AN EVEN GREATER FUTURE ROLE IN FLORIDA'S VAST FARM AND AGRIBUSINESS STRUCTURE.

FORESTRY

THE AGRICULTURE WEATHER PROGRAM PLAYS A KEY ROLE IN THE PROTECTION OF FLORIDA'S 17.1 MILLION ACRES OF FORESTS BY PROVIDING A CONSTANT STREAM OF INFORMATION REGARDING TEMPERATURE, HUMIDITY, AND OTHER WEATHER CONDITIONS WHICH HELP GUAGE THE DANGER OF FIRE AND ASSISTS THE FOREST SERVICE AND THE FLORIDA DIVISION OF FORESTRY TO MAKE NECESSARY PREPARATIONS DURING DANGER PERIODS. CONTINUOUS WEATHER MAPPING ENABLES OUR FORESTERS TO KEEP TABS ON INSECT ACTIVITY AND THE TIMING OF PEST MANAGEMENT ACTIVITIES.

SATELLITE WEATHER MAPPING

THE NATIONAL WEATHER SERVICE STATION IN RUSKIN, FLORIDA IS THE GROUND LINK TO GATHER SATELLITE WEATHER INFORMATION USED BY THE UNIVERSITY OF FLORIDA'S INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES IN THE DEVELOPMENT OF DETAILED ELECTRONIC WEATHER MAPS. THIS SYSTEM WILL EVENTUALLY ALLOW TRANSMISSION OF AGRICULTURAL WEATHER MAPS WHICH CAN BE DISPLAYED ON HOME TELEVISION SETS. THE WEATHER SERVICE IS A NECESSARY LINK TO CONNECT GROUND STATION WEATHER INFORMATION WITH SATELLITE DATA TO ALLOW THIS CAPABILITY.

FRUITS AND VEGETABLES

THE AGRICULTURE WEATHER SERVICE HAS THE CAPABILITY, EXPERIENCE AND EQUIPMENT NECESSARY TO HELP FARMERS MINIMIZE LOSSES DUE TO FREEZE DAMAGE. REPORTS ARE ISSUED EVERY TWO HOURS DURING SEVERE WEATHER PERIODS. THE INFORMATION ON PROJECTED LOW TEMPERATURES, TIMING, DURATION, INVERSION LEVELS, WIND, CLOUD COVER, ETC. ENABLE FARMERS TO MAKE DECISIONS FOR THE PROTECTION OF THEIR CROPS. THIS PROTECTION CONSISTS OF IRRIGATION, WIND MACHINES, AND PETROLEUM FUELED HEATERS. BY DELAYING SUCH PROTECTION UNTIL THE CRITICAL TIME, FARMERS CAN EFFECT GREAT SAVINGS IN WATER, ENERGY, AND EXPENSE. BY SAVING A CROP WHICH WOULD OTHERWISE HAVE BEEN LOST, THE FARMER CAN PROVIDE LOWER COST FOOD FOR THE CONSUMER, AVOID UNEMPLOYMENT AND ITS ATTENDANT COST TO THE FEDERAL TREASURY, AND PROTECT THE PROFITS WHICH GENERATE FEDERAL REVENUES.

AS A RESULT OF TIMELY WEATHER INFORMATION, FARMERS CAN SAVE MILLIONS OF DOLLARS IN A SINGLE NIGHT. FRED CROSBY, CHIEF METEOROLOGIST AT THE WEATHER STATION IN RUSKIN, FLORIDA, FOUND "IN THE 1977 FREEZE, THE INFORMATION WE PROVIDED SAVED CITRUS GROWERS IN LAKE AND ORANGE COUNTIES ALONE BETWEEN $5 and $7 MILLION." (LAKE AND ORANGE COUNTIES ARE ONLY TWO OF ABOUT 25 WHICH ARE LARGE CITRUS PRODUCERS).

ASSUMING A MARGINAL INCOME TAX RATE OF 30%, THE ADDITIONAL FEDERAL REVENUES FROM THESE TWO COUNTIES ALONE WOULD PAY THE ENTIRE COST OF THE NATION'S AGRICULTURAL WEATHER SERVICE FOR OVER A YEAR.

AGRICULTURAL MANAGEMENT PRACTICES

THE AGRICULTURAL WEATHER SERVICE ALSO PROVIDES VALUABLE INFORMATION FOR AGRICULTURAL MANAGEMENT PRACTICES. SOIL TEMPERATURES, WIND SPEED AND VELOCITY, EVAPORATION RATES, VEGETATIVE WETTING, AND MOISTURE MEASUREMENT ARE ALL FACTORS TO DETERMINE OPTIMUM PLANTING TIMES. ANALYSIS OF WIND SPEED AND DIRECTION ARE IMPORTANT FOR AGRICULTURAL AVIATION TO MINIMIZE THE APPLICATION OF COSTLY AGRICULTURAL CHEMICALS. MOREOVER, AN UNEXPECTED RAIN STORM FOLLOWING A PESTICIDE APPLICATION CAN RESULT IN AN ECONOMIC LOSS AS WELL AS THE INTRODUCTION OF UNMETABOLIZED PESTICIDES INTO THE SOIL.

INTEGRATED PEST MANAGEMENT

CONTINUED DEVELOPMENT OF INTEGRATED PEST MANAGEMENT HOLDS GREAT PROMISE FOR LOWER FOOD PRODUCTION COSTS AND IMPROVED ENVIRONMENTAL QUALITY. AGRICULTURAL WEATHER DATA IS AN IMPORTANT ELEMENT OF SUCH PROGRAMS AND IT IS DESIRABLE FOR FARMERS, CONSUMERS, AND THE PUBLIC AT LARGE THAT THIS INFORMATION CONTINUE TO BE AVAILABLE.

A SINGLE INTEREST GROUP?

A STRONG, HEALTHY AGRICULTURE IS NOT ONLY IN THE INTEREST OF FARMERS. THE PRODUCTION OF FOOD AND FIBER IS IN THE INTEREST OF EVERY PERSON WHO LIKES CLOTHING, SHELTER, AND THREE SQUARE MEALS A DAY. AGRICULTURE IS OUR NATION'S LARGEST INDUSTRY, OUR NATION'S LARGEST EMPLOYER, OUR NATION'S LARGEST CONTRIBUTOR TO THE INTERNATIONAL BALANCE OF TRADE. BECAUSE OF OUR EFFICIENT AGRICULTURAL INDUSTRY, AMERICANS ENJOY THE LARGEST QUANTITY AND QUALITY OF WHOLESOME, FRESH FOOD AT THE LOWEST COST OF ANY COUNTRY IN THE WORLD (ONLY 16% OF DISPOSABLE INCOME IS USED FOR THE PURCHASE OF FOOD). OUR AGRICULTURAL SYSTEM ALLOWS 97% OF OUR POPULATION TO PURSUE VOCATIONS OF THEIR OWN INTEREST WITHOUT HAVING TO WORRY ABOUT WHERE THEIR FOOD IS COMING FROM.

PRIVATIZATION

THE TRANSFER OF GOVERNMENT PROGRAMS AND ACTIVITIES TO THE PRIVATE SECTOR IS A CONCEPT OF CONSIDERABLE MERIT AND THE FEASIBILITY OF THIS SHOULD BE CONTINUALLY EXPLORED. FREQUENTLY THE RESULT IS GREATER EFFICIENCY, SUPERIOR SERVICE OR PRODUCT, AND A WELCOME REDUCTION IN FEDERAL SPENDING. IF IT COULD BE SHOWN THAT SUCH EFFICIENCY COULD BE OBTAINED BY THE PRIVATIZATION OF THE AGRICULTURAL WEATHER SERVICE, IT SHOULD BE IMPLEMENTED WITHOUT DELAY. GIVEN THE COMPLEXITY AND DIVERSITY OF OUR AGRICULTURAL INDUSTRY, NO ONE HAS BEEN ABLE TO DESIGN A SYSTEM WHICH EVEN APPROACHES THE EFFICIENCY OF OUR PRESENT AGRICULTURAL WEATHER SERVICE. GIVEN THE VERY LOW COST OF THIS SERVICE, (ONLY $1.5 MILLION PER YEAR), IT APPEARS VERY UNLIKELY THAT A FEASIBLE PRIVATE SECTOR APPROACH WILL BE DEVISED IN THE FORESEEABLE FUTURE.

THE AGRICULTURAL WEATHER SERVICE IS ONE OF THE FEW PROGRAMS WHICH RETURNS A "PROFIT" TO THE FEDERAL TREASURY IN THE FORM OF INCREASED TAX REVENUES AND REDUCED SPENDING. IF ALL GOVERNMENT PROGRAMS OPERATED ON THIS BASIS, WE WOULD ENJOY HUGE BUDGET SURPLUSES, RATHER THAN THE CURRENT DEFICITS. CLEARLY THERE IS NO MERIT OR ADVANTAGE TO THE DISCONTINUANCE OF THIS VITAL SERVICE.

SUMMARY

IN SUMMARY, THE CURRENT AGRICULTURE WEATHER PROGRAM IS VITAL TO OUR NATION'S LARGEST INDUSTRY, PROVIDES SIGNIFICANT BENEFITS TO CONSUMERS, CARRIES IMPORTANT ENVIRONMENTAL CONSIDERATIONS, AND IS A CREDIT IN THE NATION'S BALANCE SHEET.

THIS PROGRAM HAS GENERATED FAR MORE THAN ITS COST IN FEDERAL REVENUES. IT HAS SAVED THE GOVERNMENT HUNDREDS OF MILLIONS BY KEEPING FARMERS IN BUSINESS, MAINTAINING FARM EMPLOYMENT, AND PROVIDING CONSUMERS WITH QUANTITIES OF WHOLESOME AND INEXPENSIVE FOOD. THERE IS SIMPLY NO EFFECTIVE SUBSTITUTE FOR THIS SERVICE AVAILABLE IN THE PRIVATE SECTOR.

WE RESPECTFULLY REQUEST THAT YOU DO EVERYTHING POSSIBLE TO CONTINUE THIS IMPORTANT SERVICE AND MAINTAIN IT AT AN ADEQUATE FUNDING LEVEL.

IF YOU HAVE ANY QUESTIONS, I WOULD BE HAPPY TO RESPOND.

Mr. **Brown**. We will proceed in order to Mr. Flowers. Before he presents his statement, I would like to ask our distinguished member from Mississippi, Mr. Franklin, if he has a good word to say about Mississippi.

Mr. **Franklin**. Thank you, Mr. Chairman. I certainly do.

It is pleasure, colleagues, to welcome one of my good friends to this committee, Dick Flowers. He is from Tunica, MS. He is the immediate past president of Delta Council, which I think is one of the finest farm organizations in the country. He now serves as the chairman of the executive board of directors.

Dick is an active farmer and a true leader in the formulation of farm policy in our part of the country and, I think, for the Nation.

Dick, it is always a pleasure to see you and have you with us.

Thank you, Mr. Chairman, for letting me welcome this distinguished gentleman from Mississippi.

Mr. **Brown**. Do you want to welcome Mr. Morgan, too?

Mr. **Franklin**. I didn't see him. Oh, Chip is right behind him. Chip is executive director of Delta Council, that fine farm organization I was talking about. I spent all day yesterday with Chip, so I have seen him. I want to welcome him here to this committee.

Thank you, Mr. Chairman.

Mr. **Brown**. All right.

Now, Mr. Flowers, you can go ahead.

Mr. **Flowers**. Thank you, sir.

STATEMENT OF RICHARD FLOWERS, CHAIRMAN, EXECUTIVE COMMITTEE, DELTA COUNCIL, STONEVILLE, MS

Mr. **Flowers**. My name is Dick Flowers, and I am a cotton and soybean farmer from Tunica County, MS. I am serving this year as chairman of the executive committee of Delta Council, an area economic development organization representing the 18 delta and part-delta counties of Mississippi.

Delta Council is supported by the agricultural, business and professional leaders of the area and serves as a medium through which action can be coordinated to solve problems and to initiate economic programs aimed at improving the Nation's economy.

We are grateful to you for scheduling this meeting and for the attention that you are focusing on the importance of agricultural weather operations.

Agriculture is the Nation's largest industry. In 1982, farm assets were equal to about 70 percent of the capital assets of all manufacturing corporations in the United States.

Also, agriculture is the Nation's largest employer. Not only is agriculture of tremendous importance to our domestic economy; the slightly more than 2 percent of our population engaged in farming produce the food and fiber for the remaining 97-plus percent of our citizens, with enough left over to provide between $30 billion and $40 billion in agricultural export.

It should be noted that the products of agriculture are essential in sustaining life itself. I cite these facts, which I am sure are well known by you gentlemen, to highlight the importance of timely and accurate agricultural weather information to successful farming.

Of the many factors affecting the success or failure of agricultural enterprises, none plays a more decisive role than weather, which manifests its influence on every phase of plant and animal growth and development. In fact, every decision in farm planning must take into account expected weather conditions.

High input costs, reflecting the upward pressures of inflation, have accelerated so dramatically in recent years that a new risk dimension now exists, and farmers are much more vulnerable than in the past to the impact of weather and weather-related losses.

Because of the urgent need for timely weather information, Congress, in the late 1950's, directed the Weather Bureau to provide specialized agricultural services. A pilot project of services, research, and cooperation was initiated.

While meagerly financed, this program has been intensively utilized in the mid-South and, within the limits of supporting capability, has provided effective services. Currently, there are four regional agricultural weather centers. One of these is located in Stoneville, MS, where it coordinates efforts with agricultural research programs being carried forward by the Delta Branch Experiment Station and the USDA.

Others are at Auburn University, College Station, Texas A&M, and Purdue University. Locations of these agricultural weather centers with land-grant college facilities are designed to take advantage of the agricultural research programs under way at these locations so that Weather Services personnel can have the benefit of a close working relationship with State and Federal agricultural research scientists.

Original plans called for expansion of these centers to other areas of the United States. However, these expansions have not been made. Instead, funding for the Agricultural Weather Program has been continually threatened by budget makers who have even proposed discontinuing agricultural weather services altogether.

Considering the small cost involved in providing agricultural weather services—approximately $1.5 million in 1983—the tremendous benefits accruing from these services, and the urgent need for timely weather information, it is impossible for us today to understand why anyone would propose the elimination of such an important program.

While it is difficult to provide accurate data detailing specific dollar benefits accruing from Agriculture Weather Service Programs, studies made in the Mississippi Delta in 1978 by Drs. Marlott and Priddy of Colorado State University showed that the availability of timely weather information meant a potential 16 percent saving in the cost of growing cotton in Mississippi. In 1981, that amounted to nearly $57 million in savings for only one crop in only one State.

In November 1979, Harold A. Scott, who at that time was Director of the Agricultural Weather Program, National Weather Services, and Howard F. Lehnert, SEA-E, U.S. Department of Agriculture, prepared a short summary of the Agricultural Weather Program which stated in part: "Each year, farmers spend $1 billion for pesticides—insecticides, bactericides, fungicides, and nematicides. Researchers estimate that a fully implemented Agricultural Weather Program to support efforts in integrated pest management could result in a 20-percent reduction in the amount of pesticides used each year in the United States.

"About one-quarter of the herbicides applied by farmers in the United States each year are ineffective because of ineffective timing of application in relation to existing weather conditions."

Other studies made over the years have indicated that preventable weather losses averaged nearly 7 percent of cash receipts annually. The benefits are in the form of increased yields, improved quality, reduced costs, reduced losses, better marketing opportunities, reduced energy consumption, and less pollution.

Commenting on benefits received by farmers from the Agricultural Weather Service Program, Dr. Michael Flynn, a meteorologist in charge of the regional AWS unit at Texas A&M University, commented in 1982 that the weather advisory program was worth some $100 million a year to Texas farmers alone. The Texas A&M unit serves Oklahoma and New Mexico in addition to Texas.

I have provided other documented illustrations of benefits that have been accrued from the Agricultural Weather Program in a statement that we are filing for the record, including information on the Degree-Day-50 Program for rice. I would like to call attention to the special report to the President and Congress entitled, "The Future of the Nation's Weather Services," prepared by the National Advisory Committee on Ocean and Atmosphere and printed in July 1982.

In addition to providing strong support for strengthening the National Weather Services, the advisory committee expressed concern that the effectiveness of the National Weather Services was being hobbled by failure to provide resources and personnel in spite of increasing requirements placed upon the agency.

Additionally, speaking to the question of whether the Federal Government should provide special weather service for the private sector, the report stated, "We see a continuing need for a Federal role in the provision of forecasts for broad economic segments such as agriculture, maritime activities, and aviation because of substantial national interest in the efficiency, safety, and productivity of these sectors."

On the subject of user fees, the advisory committee concluded that the implementation of user fees may be practical only in special cases. The report specifically stated, "Services designed to protect life and property should not be withheld from those unable or just unwilling to pay. Some sectors such as shipping, agriculture and aviation, bulk so large in the economy and the national interest is so strong that the Federal Government continues to have the important responsibility of providing weather services aimed at increasing their productivity and efficiency."

We would like to take this opportunity to commend the report on agricultural weather prepared by the Agricultural Research Institute's Panel on Agricultural Meteorology. We strongly endorse the need for a fully coordinated and effective Agricultural Weather Program. However, we believe that the National Weather Services should continue as the lead agency.

The private sector should be encouraged to complement and support a national agricultural weather system. We do not believe, however, that the private sector has the resources that are essential in operating an effective agricultural weather program. Also, we are strongly opposed to the implementation of user fees except in very specialized cases.

We believe that a mandate by Congress in support of a more effective agricultural weather program would represent the most effective step that could be taken to assure that the vitally important services will be provided in a timely and effective manner.

In closing, we wish to express our appreciation to you for your interest and your support. We urge that you continue to provide active support for this very important program and that steps be taken to make sure that the agricultural weather program is more adequately funded.

[The prepared statement of Mr. Flowers follows:]

DELTA Council
THE ORGANIZATION OF THE YAZOO-MISSISSIPPI DELTA
PROMOTING AND DEVELOPING THE ECONOMY AND SOCIETY OF ITS AREA
STONEVILLE, MISSISSIPPI 38776

June 27, 1984

Congressman George E. Brown, Jr., Chairman,
House Agriculture Committee's Subcommittee
on Department Operations, Research and
Foreign Agriculture

Congressman James Scheuer, Chairman,
House Science and Technology Committee's
Subcommittee on Natural Resources,
Agriculture Research and Environment

Re: Joint Oversight Hearings on National Agricultural Weather Operations

Mr. Chairmen and Members ~~of~~ the Subcommittees,

My name is Dick Flowers. I am a cotton and soybean farmer from Tunica, Mississippi, and am serving this year as chairman of the Executive Committee of Delta Council, an area economic development organization representing the 18 Delta and part-Delta counties of Mississippi. Delta Council is supported by the agricultural, business and professional leaders of the area and serves as a medium through which action can be coordinated to solve problems and to initiate economic programs aimed at improving the area's economy. While Delta Council serves all segments of our economy, agriculture is of tremendous importance to our area. Cotton, soybeans, rice and farm-raised catfish are our principal products.

We are very grateful to you for scheduling this hearing and for the attention that is being given to National Agricultural Weather operations. The background information that was provided concerning the Joint Oversight Hearing focuses attention on the importance of an Agricultural Weather System in a very excellent manner.

As you know, agriculture is the Nation's biggest industry. Farm assets, totaling $1,092 billion on January 1, 1982, were equal to about 70 percent of the capital assets of all manufacturing corporations in the United States. Agriculture is also the Nation's largest employer with approximately 23 million people working in some phase of agriculture. Another five million people provide agribusiness supplies and services. This adds up to approximately one out of every five jobs in private enterprise.

Not only is agriculture of tremendous economic importance, the slightly more than two percent of our population engaged in agriculture produce the food and fiber for the remaining 97 plus percent of our citizens with enough left over to provide between $30 and $40 billion in agricultural exports.

I cite these facts, which I am sure are well known by you gentlemen, to highlight the importance of timely and accurate agricultural weather information. In fact, of the many factors affecting the success or failure of agricultural enterprises, none play a more decisive role than weather, which manifests its influence on every phase of plant and animal growth and development.

High input costs, reflecting the upward pressures of inflation, have accelerated so dramatically in recent years that a new risk dimension now exists and farmers are much more vulnerable than in the past to the impact of weather and weather-related losses. This means that timely weather information is more important than ever before, not only to farmers but to customers who depend upon farmers for their food and fiber needs. In fact, every decision in farm planning must take into account expected weather conditions. Farming has become heavily dependent upon machines and chemicals and each operation that has to be repeated because of adverse weather conditions adds to production costs.

In recent years, we have been threatened by shortages of fuels, pesticides and other petroleum-based products. These and other factors emphasize the urgent need for more accurate and timely weather information that farmers can use in their daily operations to reduce risks in crop and livestock production. Also, inflation is contributing to higher production costs, greater risks and a narrower profit margin, making it more important that weather risks in crop production be minimized.

In the late 1950s, Congress recognized the urgent need that farmers have for timely weather information and directed the Weather Bureau to provide specialized agricultural services. A pilot project of services, research and cooperation was initiated. This program, while meagerly financed, was intensely utilized in the Midsouth area and, within the limits of support and capability, has provided effective services. Currently, there are four Regional Agricultural Weather Centers. One of these is located at Stoneville, Mississippi, where it coordinates efforts with agricultural research programs being carried forward by the Delta Branch Experiment Station and the USDA. Others are at Auburn University, College Station, Texas and Purdue University. Locations of these Agricultural Weather Centers with Land Grant College facilities are designed to take advantage of the agricultural research programs under way at these locations so that Weather Service personnel can have the benefit of a close working relationship with State and Federal agricultural research scientists. Original plans called for expansion of these Centers to other areas of the United States; however, these expansions have not been made. Instead, the Agricultural Weather program has been continually threatened by cuts in funding and even by proposals to discontinue agricultural weather services altogether.

Considering the tremendous benefits provided by the Agricultural Weather Program and the small costs involved (approximately $1.5 million in 1983 according to background information provided for this hearing), it is impossible for us to understand why proposals have been initiated to eliminate the program.

While it is difficult to provide accurate information concerning specific benefits accruing to agriculture from the Agricultural Weather Service program, studies made in the Mississippi Delta in 1978 by Dr. Marlott and Priddy of Colorado State University showed that the availability of timely weather information meant a potential 16 percent savings in the cost of growing cotton in Mississippi. In 1981, that amounted to nearly $57 million in savings for only one crop in only one State.

In November 1979, Harold A. Scott, who at that time was Director of the Agricultural Weather Program, National Weather Service, and Howard F. Lehnert, SEA-E-USDA, prepared a short summary of the Agricultural Weather Program which stated in part -- "each year, farmers spend $1 billion for pesticides -- insecticides, bactericides, fungicides and nematicides. Researchers estimate that a fully implemented Agricultural Weather Program to support efforts in integrated pest management could result in a 20 percent reduction in the amount of pesticides used each year in the United States.

"About one-quarter of the herbicides applied by farmers in the United States each year are ineffective because of incorrect timing of application in relation to existing weather conditions.

"Irrigation is a critical component in the Nation's agriculture, Research shows irrigation's efficiency can be improved by some 35 percent through use of Agricultural Weather data in irrigation."

Other studies made over the years have indicated that preventable weather losses averaged nearly seven percent of cash receipts annually. The benefits are in the form of increased yields, improved quality, reduced costs, reduced losses, better marketing opportunities, reduced energy consumption and less pollution.

Commenting on benefits received by farmers from the Agricultural Weather Service program, Dr. Michael Flynn, Meteorologist In Charge of the Regional AWS Unit at Texas A&M University, commented in 1982, that the Weather Advisory Program was worth some $100 million a year to Texas farmers alone. The Texas A&M Unit serves Oklahoma and New Mexico in addition to Texas.

"The Agricultural Weather Service is in the business of providing farmers and ranchers with seasonal weather information as well as up-to-the-minute information to help them make better day-to-day decisions regarding critical operations." Mr. Flynn explained.

For instance, soil temperature data are critical at planting time, he pointed out. Farmers that plant in soil that is too cold will likely get poor stands and have to replant, thus increasing their production costs. Information on the wind, evaporation, relative humidity and dew formation are critical to spraying, harvesting and other operations. If spray operations have to be repeated because of weather problems or if rain or other factors cause harvest losses, the farmer's costs go up. Eventually, those increased costs show up at the supermarket in the form of higher priced or lower quality food products, Mr. Flynn stated.

In a statement on August 13, 1982, Congressman David Bowen pointed out that the Agricultural Weather Service had saved farmers at least $750 million annually in production costs on major commodities such as soybeans, cotton, fruits and vegetables. "In a free market such as we have, this translates into higher production and lower prices for consumers," Congressman Bowen stated. In a letter to members of the Mississippi Congressional Delegation dated March 28, 1983, Dr. James R. Carpenter, Director, Mississippi Cooperative Extension Service, said that the information provided by the Agricultural Weather Service Center at Stoneville, Mississippi, has been extremely beneficial to the Mississippi farm industry. He said that it provided local agricultural weather forecasts that are not available from any other source. This information is used not only by Mississippi farmers but also by many agricultural-related businesses.

"If the data provided saved Mississippi cotton producers one application of insecticides in 1982, the total savings to all cotton producers in the State were about $6.6 million. Many believe that the Service did at least that. If the data provided saved all Mississippi crop producers just one trip over the field during land preparation on just half of our total cropland, the savings in fuel, oil and repairs approached $20 billion. Other similar examples can be quickly calculated that show additional savings of millions of dollars",the Extension Service Director said.

With further regard to specific benefits accruing from the Agricultural Weather Program in this area, I would like to call your attention to the "Degree Day 50" program. This concept was initiated by one of the agricultural meteorologists connected with the Agricultural Weather Program and the techniques have been tested and refined over the past several-year period. As of the end of 1981, approximately 2500 rice growers in Mississippi and Arkansas representing 588,000 acres were users of this program.

Farmers who participate in the program provide their County Agent with emergence data for individual varieties by individual fields. The County Agent checks this data and sends it on to the Midsouth Agricultural Weather Service Center here at Stoneville. Agricultural meteroloists then project the growth of the crop using weather forecasts, crop growth models and computers. Printouts are then sent back to each individual farmer.

Enclosed you will find a brief explanation of the "DD 50" program to which you will find attached a sample "printout" which provides an accurate schedule for the farmer to use in carrying out essential crop production practices in a timely manner. A similar program has been developed for cotton and is known as "DD 60."

I would like to call attention to the Special Report to the President and the Congress entitled, "The Future of the Nation's Weather Services," prepared by the National Advisory Committee on Ocean and Atmosphere and printed in July 1982. In addition to providing strong support for strengthening the Nation's Weather Service, the Advisory Committee expressed concern that the effectiveness of the National Weather Service is being hobbled by failure to provide resources and personnel in spite of increasing requirements placed upon the Agency. "We believe that the National Weather Service is now at a point where it may not be able to provide the warnings and protection expected of it in the face of major national catastrophes," the report stated.

Additionally, in speaking to the question of whether the Federal Government should provide specialized weather services for the private sector, the report stated, "We see a continuing need for a federal role in the provision of forecasts for broad economic segments, such as agriculture, maritime activities and aviation, because of the substantial national interests in the efficiency, safety, and productivity of these sectors."

On the subject of user fees, the Advisory Committee concluded that the implementation of user fees may be practical only in special cases. The report specifically states, "Services designed to protect life and property should not be withheld from those unable or just unwilling to pay. Some sectors such as shipping, agriculture and aviation, bulk so large in the economy and the national interests is so strong that the Federal Government continues to have the important responsibility for providing weather services aimed at increasing their productivity and efficiency.

We would like to take this opportunity to commend the report on Agricultural Weather prepared by the Agriculture Research Institute's Panel of Agricultural Meteorology. We strongly endorse the need for a fully coordinated and effective Agricultural Weather Program; however, we believe that the National Weather Service should continue as the lead agency.

The private sector should be encouraged to complement and support a National Agricultural Weather System. We do not believe, however, that the private sector has the resources that are essential in operating an effective Agricultural Weather Program. Also, we are strongly opposed to the implementation of user fees except in very specialized cases.

We believe that a mandate by Congress in support of a more effective Agricultural Weather Program would represent the most effective step that could be taken to assure that these vitally important services will be provided in a timely and effective manner.

In closing, we wish to express our appreciation to you for your interest and your support. We urge that you continue to provide active support for this very important program and that steps be taken to make sure that the Agricultural Weather Program is more adequately funded.

Respectfully submitted,

Dick Flowers, Chairman
Delta Council Executive Committee

THE MID-SOUTH RICE DD50 PROGRAM

The Mid-South Rice DD50 Program has become very important to rice producers in Arkansas and Mississippi. The number of growers participating grows every year. By the end of 1981, around 2,500 rice growers covering 588,000 acres used the program.

What is the RICE DD50 Program? It is rice production management aid. Participating farmers collect emergence data of individual fields and send this data to their county agent. The agent then checks the field data and sends it to the Mid-South Agriculture Weather Service Center. Agricultural meteorologists at the Center then project the growth of the crop using weather forecasts, crop growth models, and computers. Then, the printouts are sent to farmers. This gives a farmer a "long-term" forecast for each of his fields. He carries this in his pickup, so he can be on the lookout and plan ahead. A sample "printout" is attached.

The DD50 Program is extremely popular. One of the key ingredients is weather support coming from the Mid-South Agriculture Weather Service Center.

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    MISSISSIPPI STATE UNIVERSITY AND NATIONAL WEATHER SERVICE
                         COOPERATING


            RICE GROWTH AND MANAGEMENT PREDICTIONS
                        MARCH 15, 1982

                 FIELD   GENO          JUDY          JENNY         JEFF
                 ACRES   100           200           300           400
                 VARIETY LEBONNET      LEBONNET      LEBONNET      LEBONNET
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MANAGEMENT ACTIVITY
OR GROWTH STAGE

PLANT                        3 - 15        4 - 15        5 - 15        6 - 15
EMERGE                       4 - 9         4 - 27        5 - 23        6 - 21
DRAIN FOR STRAIGHTHEAD       5 - 22        6 - 2         6 - 22        7 - 17
BEGIN PHENOXY APPLICATION    5 - 30        6 - 10        6 - 28        7 - 23
BEGIN CHECKING INTERNODES    6 - 5         6 - 15        7 - 3         7 - 28
BEGIN SHEATH BLIGHT SCOUTING 6 - 5         6 - 15        7 - 3         7 - 28
END PROPANIL APPLICATION     6 - 8         6 - 19        7 - 7         8 - 1
END PHENOXY APPLICATION      6 - 8         6 - 19        7 - 7         8 - 1
APPLY MIDSEASON NITROGEN     6 - 10        6 - 20        7 - 8         8 - 3
END SHEATH BLIGHT SCOUTING   6 - 21        6 - 30        7 - 18        8 - 12
HEADING                      7 - 6         7 - 15        8 - 2         8 - 28
HARVESTING                   8 - 10        8 - 19        9 - 6         10 - 2
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    MISSISSIPPI STATE UNIVERSITY AND NATIONAL WEATHER SERVICE
                         COOPERATING


            RICE GROWTH AND MANAGEMENT PREDICTIONS
                        MARCH 15, 1982

                 FIELD   JOANNA
                 ACRES   500
                 VARIETY LEBONNET
*********************

MANAGEMENT ACTIVITY
OR GROWTH STAGE

PLANT                        7 - 15
EMERGE                       7 - 21
DRAIN FOR STRAIGHTHEAD       8 - 16
BEGIN PHENOXY APPLICATION    8 - 22
BEGIN CHECKING INTERNODES    8 - 28
BEGIN SHEATH BLIGHT SCOUTING 8 - 28
END PROPANIL APPLICATION     8 - 31
END PHENOXY APPLICATION      8 - 31
APPLY MIDSEASON NITROGEN     9 - 2
END SHEATH BLIGHT SCOUTING   9 - 13
HEADING                      10 - 2
HARVESTING                   11 - 6
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Mr. Brown. Thank you very much, Mr. Flowers.

Now, Ms. Harner, please proceed with your statement.

STATEMENT OF MILLIE GODFREY HARNER, GENERAL MANAGER, IMPERIAL COTTON PRODUCTS, ON BEHALF OF THE NATIONAL COTTON COUNCIL

Ms. Harner. Mr. Chairman and members of the subcommittee, I am Millie Godfrey Harner, general manager of Imperial Cotton Products, a cotton gin in Holtville, CA, Imperial County, testifying on behalf of the National Cotton Council.

The council has been a member of the Agricultural Research Institute for many years and concurs in the conception of the blueprint on agricultural weather system developed by ARI.

We are indebted to Dr. John Barthollic, of the Michigan State University, for his dedication and leadership as chairman of the ARI's Agricultural Meteorology Panel, including the blueprint.

With me today is Dr. Jim Brown, the council's production technology manager, who has served on the Agricultural Research Institute's Meteorology Panel for a number of years and has participated in several national workshops and meetings on weather climate.

The council, as a central organization of the U.S. cotton industry, represents producers, processors, and handlers from California to the Carolinas.

At the council's annual meeting this year, delegates called for Federal funding for agricultural weather services that would be adequate to provide needed services without implementing user fees. For many years, the cotton industry has strongly supported this program.

The council, and the Delta Council of Mississippi, were among the first farm organizations in the Nation to push for specialized agricultural weather services because they recognized how essential it is for farmers to have timely, accurate weather information packaged for their needs.

Agricultural weather information is a valuable input into our country's farm production system. Weather has to be taken into consideration in every farming and ranching operation in the country. Having access to agricultural weather has helped our farmers attain continuous increases in productivity beyond that of any other major segment of our economy.

Because of these increases, U.S. consumers now pay less of their disposable income for food than citizens of any other country. In addition, U.S. farm exports, estimated at $37.5 million this year, are a major positive factor in our Nation's balance of payments.

Besides contributing to the economy, agricultural weather services also contribute to a stronger national defense, a cleaner environment, and to the public's health.

A 1982 report issued by the National Academy of Sciences described the production, harvesting, processing, and marketing of agricultural commodities as "the most climate-sensitive industries in our economy."

Over the past 15 to 20 years, technological capabilities for gathering and disseminating weather information have improved tremendously. We now have weather satellites that can continuously feed information into a central station, and sophisticated computers that can adapt this information for the specific needs of agricultural and other users. Electronic communication capabilities now make it possible for other, smaller computers to obtain radar data from the National Weather Services and localize it.

These and other advanced technologies make agricultural weather information highly current. Technological improvements also have been made in agriculture that intensify the need for specialized weather information.

Timely and accurate rain forecasts are especially important with the high cost of today's pesticides. A farmer can save $10 or more an acre by avoiding just one insecticide application being washed off a few hours later. Or, in the case of some pre-emergent herbicides, money is saved by knowing when to expect the rain necessary for activating this chemical.

In the Imperial Valley of southern California where I live, hot dry winds may blow 2 or 3 days at a time. Forecasts of such conditions are extremely important for efficient and safe use of insecticides on cotton and other crops.

Alfalfa is another major crop in my area. Typically, it is cut and windrowed until it is dried to the proper stage for baling. Hot dry winds can scatter the cut alfalfa or dry it to the point where it cannot be efficiently baled.

Temperature and moisture conditions at planting, germination and emergence are also extremely critical. Without adequate soil moisture and warm temperatures in the early season, stands will be greatly reduced. The crop seedlings that do develop grow more slowly and are subject to greater damage from diseases, insects, chemicals and other factors.

In our area, we depend on irrigation for achieving the desired soil moisture level. A dry wind blowing over a wet bed causes an evaporative cooling effect on the soil which adversely affects the crop in early season.

Rain and wind forecasts in the fall are critical for defoliating and harvesting cotton and for taking steps to prevent insect pests like the boll weevil from entering a state of diapause that allows it to survive in the winter. As the temperature warms in the spring, the overwintered pest emerging from hibernation can quickly build to crop-damaging populations.

In California, timely frost information is extremely valuable for protecting our large fruit and vegetable crops and for scheduling harvesters.

In those parts of the Cotton Belt where cotton is harvested once-over with mechanical strippers, forecasts of killing frost can save the farmer the unnecessary cost of applying a desiccant to condition the crop for harvesting.

In the Mississippi Delta, information on wind and temperature inversions is essential in scheduling aerial applications of rice crop herbicides to prevent drift damage to nearby cotton.

Today's agricultural weather information needs to go beyond these few examples of traditional uses. More and more farmers are making crop management decisions on the basis of heat units. Under this system, they monitor the growth and development of their crops in relation to the amount of heat units accumulated since planting or emergence and adjust their cultural practices accordingly.

The development stages of pests also can be accurately determined and predicted through heat units. This has far-reaching implications in pest management. Keeping track of spring emergence, egg-laying periods, and generation times based on daily heat inputs allows farmers to predict insect development without the guesswork that goes with using calendar dates which, of course, are not sensitive to changing temperature patterns.

Models are being developed to facilitate integration of weather information with production inputs. The need for timely and accurate agricultural weather information will continue to grow along with development of new technology in agricultural production.

America's agriculture is broad and diverse, with several million farmers and ranchers involved in producing a wide variety of crops and livestock. Just as weather varies from one agricultural area to the other, so do needs for specific agricultural weather service. It is totally impractical for broad and diverse farming communities to organize and to provide their own agricultural weather services effectively.

We strongly believe the public sector will have to continue to be the major provider of weather services for U.S. farmers and ranchers and that the major responsibility for providing these services lies with the Federal Government, cooperating with the States.

In some instances, private sellers of agricultural weather services can and do play a role. We certainly don't oppose these efforts but rather encourage the private sector to provide services complementary to those by the public sector.

In this regard, we concur with the National Advisory Committee on Oceans and Atmosphere. In its 1982 report to the President and the Congress, the committee advocated that the Federal Government continue providing specialized analyses and forecasts that serve broad economic sectors, especially where there is a high national interest.

As I indicated earlier, the National Cotton Council supports adequate funding for agricultural weather services without user fees. This same point was made by the National Advisory Committee in its report. The committee said it is frivolous to propose charging user fees for agricultural weather services because their benefits are widely distributed over a broad segment of the population and because agriculture is so central to our national welfare. We heartily agree with this.

The cotton industry strongly supports a single Federal lead agency for agricultural weather services. We think the gathering of weather information should continue in an agency like the National Weather Services. We also recognize that USDA and State land-grant institutions should play a major role in researching and establishing agricultural weather information needs and carrying out educational activities so the services can be utilized to the fullest.

American agriculture needs a strong, federally funded specialized weather service. Such a program serves our country's welfare. One of the most important actions Congress can take is to establish a mandate in this regard.

In closing my remarks, I have a somewhat more detailed written statement that I would like to submit to the committee for the record of this hearing.

Mr. **Brown**. Without objection, it will be made a part of the record.

Ms. **Harner**. Thank you, Mr. Chairman, for giving us this opportunity to present our views.

[The prepared statement of Ms. Harner follows:]

Statement on Agricultural Weather Operations
By Millie Godfrey Harner On Behalf of the National Cotton Council
at a Joint Hearing before the
Subcommittee on Department Operations, Research and Foreign Agriculture
of the House Committee on Agriculture
and the
Subcommittee on Natural Resources, Agriculture Research and Environment
of the House Committee on Science and Technology
June 27, 1984

Mr. Chairmen and Members of the Subcommittees:

I am Millie Godfrey Harner, general manager of a cotton gin in Holtville, California, testifying on behalf of the National Cotton Council.

With me is Dr. Jim Brown, the Council's production technology manager who has served on the Agricultural Research Institute's meteorology study panel for a number of years, and has participated in several national workshops and meetings on weather and climate.

The Council, as the central organization of the U.S. cotton industry, represents producers, processors, and handlers from California to the Carolinas.

At the Council's annual meeting this year, delegates called for federal funding for agricultural weather services that would be adequate to provide needed services without implementing user fees.

For many years, the cotton industry has strongly supported this program. The Council and the Delta Council of Mississippi were among the first farm organizations in the nation to push for specialized agricultural weather services because they recognized how essential it is for farmers to have timely accurate weather information packaged for their needs.

Agricultural weather information is a valuable input in our country's farm production system. Weather has to be taken into consideration in every farming and ranching operation in the country.

Having access to agricultural weather has helped our farmers attain continued increases in productivity beyond that of any other major segment of our economy. Because of these increases, U. S. consumers now pay less of their disposable income for food than citizens of any other country. In addition, U.S. farm exports -- estimated at 37-and-a-half billion dollars this year -- are a major positive factor in our nation's balance of payments.

Besides contributing to the economy, agricultural weather services also contribute to a stronger national defense, a cleaner environment, and the public health.

A 1982 report issued by the National Academy of Sciences described the production, harvesting, processing, and marketing of agricultural commodities as "the most climate-sensitive industries in our economy."

Over the past 15 to 20 years, technological capabilities for gathering and disseminating weather information have improved tremendously. We now have weather satellites that can continuously feed information into a central station, and sophisticated computers that can adapt this information for the specific needs of agriculture and other users. Electronic communication capabilities now make it possible for other, smaller computers to obtain radar data from the National Weather Service and localize it. These and other advanced technologies make agricultural weather information highly current.

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The cotton industry strongly supports a single federal lead agency for agricultural weather services. We think the gathering of weather information should continue in an agency like the National Weather Service. We also recognize that USDA and state land-grant institutions should play a major role in researching and establishing agricultural weather information needs, and in carrying out educational activities so the services can be utilized to the fullest.

American agriculture needs a strong, federally-funded specialized weather service. Such a program serves our country's welfare. One of the most important actions Congress can take is to establish a mandate in this regard.

Thank you, Mr. Chairmen, for giving us this opportunity to present our views.

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Mr. **Brown**. Thank you very much.

Now, our last panelist on this first panel will be Mr. Paul LaVine, who is county director of cooperative extension as well as a farmer from Modesto, CA.

STATEMENT OF PAUL D. LaVINE, COUNTY DIRECTOR, UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION SERVICE

Mr. **LaVine**. Thank you. My name is Paul D. LaVine. I am a resident of Modesto, CA, in Stanislaus County, which is located in the heart of the great San Joaquin Valley of California. I am the county director of the University of California Cooperative Extension in Stanislaus County. I am a specialist in grapes, walnuts, cane berries, and ornamentals. In addition, I own and operate a 15-acre vineyard.

The administration's view that the National Weather Services for agriculture is directed to a narrow interest is an erroneous one. The farmers I work with have a need for accurate weather forecasts year round. Without these forecasts, delivered by dedicated meteorologists, we would simply be lost.

Through my duties in the cooperative extension and as a farmer, I am very much aware of the fact that many of our farmers are going broke in the United States, and it seems to me that because of the extremely high cost of farming in California for such things as peaches and grapes and almonds, our farmers are going broke faster, and if we are not allowed the use of a good, sound weather forecast, we are going to go broke quicker.

I think that any of us associated with agriculture can relate to stories of asking a child, "Where does milk come from?" and being told, "It comes from Safeway." I think that for our administration to consider farming a private, narrow interest makes me wonder if they know where milk comes from.

The Fruit Frost Forecaster where I am from represents three counties—Stanislaus, San Joaquin, and Merced Counties—and our frost-susceptible crops amount to well over $1 billion. Agriculture generates over $2 billion in income in those three counties.

Aside from the food and fiber considerations, our farmers, you will have to admit, are the original environmentalists. They are concerned about the water and soil and the prevention of harmful residues, and they need accurate weather forecasts in order to provide these.

A couple of years ago, I was at a seminar, a national seminar for weather forecasters at the Davis campus of the University of California, and I was asked—and I started out to say, by only the kind of brassiness that a New Yorker can generate, and then I saw there was a New Yorker on this committee, but I am going to put it in there, anyway—but he said, "Well, isn't it enough to just tell farmers it is going to be cold tomorrow?" And it is not.

Our farmers want to know when it is going to get cold, how cold it is going to get; is the cold going to come quickly; is it going to drop in spurts; what the dew point is, what the cloud cover is; do we have any kind of a layer up there; and to just simply tell them it is going to be cold is not enough.

I want to thank this committee for letting me come before you because I think that, along with the rest of this panel, we do have an important message.

I have a calendar that is in my testimony. I will not go through it, but I just may need to point out that for every month of the year, we have something going on in farming in our area that requires good, accurate forecasts. Whether it be spring, harvesting, land leveling, whatever it might be, we need to know what the weather is going to do.

I would like this committee to know that a good deal of the knowledge that helps us to protect our fruit crops was developed in the county in which I am county director. We have found that by getting the soil smooth, firm, and moist prior to a frost, we can do a lot toward saving our almonds and our grapes and our peaches, also. We have to know, however, through a good, accurate weather forecast, whether frost is going to occur so that we can take the necessary steps.

I would like to point out another place where weather is really becoming important in farming, and that is in integrated pest management, which has been mandated by our Federal Congress, and also in this integrated pest management, we rely on weather forecasting to know when is the best time to spray these various bugs and diseases.

In our county, we have developed a thing for powdery mildew control that is saving us hundreds of thousands of dollars. Each time we put sulfur on our grapes for powdery mildew, it costs us $2.50 an acre. Through this index, in which we depend entirely on our national weather forecast, we can tell whether we are going to have to put on 6 dusts or as many as 15 dusts, and it doesn't take a calculator to show that this is going to give us a tremendous saving.

I am skipping down along here in the interest of time, but I want to tell you something that our local growers are doing that I think you would find interesting. Our local growers, through the Farm Bureau and the Grape Improvement Association, have put up almost $150,000 to purchase computerized weather stations and computers to access the weather and a telephone recording system that the National Weather Services uses.

Through these computers, the National Weather Services at Riverside, though they are not stationed in our county, can access the stations and tell what the weather is in our county, which amazes me. From 500 miles away, they can do this.

But they take this information and put it into a forecast and can tell our growers what to do and put it on this telephone system. Now, our growers have to subscribe to the telephone system, and it costs them presently $25 a year.

This gets me to the point of whether we will have private-sector weather forecasting. Our growers are concerned that if they do have private weather forecasting, the bottom line is whether they make a profit or not. If they do not make a profit and they are lost, and in the meantime we have lost our national weather forecasting, our farmers are going to be broke.

The thing I want to point out that I think you would appreciate is that we have more cheapskates in our county than we have subscribers. We have 400 subscribers to our telephone call, but our device that counts the number of calls coming in, on a day when we are having dangerous weather, frost, we record from 1,200 to 1,700 calls. Where did the rest of those calls come from?

If we have private sector, I can guarantee you that there are people who will pay for the private sector, but these same cheapskates are just going to graduate to a higher level, and I think they are going to have difficulty making a profit. I just want to point out—and I know you have heard these figures before—that in the next 16 years, the world gains another billion people, and only 5 years after that, we gain another billion people. These people have to be fed. Earl Butz, former Secretary of Agriculture, stated just before he left office, "In the next 20 years, we are going to have to learn to grow more food than has been produced since the beginning of the history of man." Believe me, part of that learning will be how climate affects our agriculture and then making use of the knowledge. Presently, the blue-collar worker spends less than 15 percent of his take-home pay for food for his family. With my close contact with the farming community, I can assure you that part of this enviable position is through the sacrifice of our farmers. Do not ask more of them by taking away the National Weather Services for agriculture.

[The prepared statement of Mr. LaVine follows:]

TESTIMONY

Paul D. LaVine testimony DORFA and NRARE hearings
on National Agricultural Weather Operations June 27, 1984

Introduction.

My name is Paul D. LaVine. I am a resident of Modesto, California in Stanislaus County, which is located in the heart of the great San Joaquin Valley of California. I am the County Director of the University of California Cooperative Extension in Stanislaus County. I am a specialist in grapes, walnuts, cane berries and ornamentals. In addition, I own and operate a 15-acre vineyard.

The Administration's view that the National Weather Service for Agriculture is directed to a narrow interest is an erroneous one. The farmers I work with have a need for accurate weather forecasts the year-around. Without these forecasts, delivered by dedicated meterologists with interests in agriculture, farmers are deprived of making the management decisions so important in agriculture today.

Through my duties in the Cooperative Extension and as a farmer, I am very much interested in retaining the National Weather Service for Agriculture and, in fact, enhancing its budget in order that farmers can take advantage of the modern aspects of weather forecasting. Farmers throughout the United States, as everyone knows, have had a tough time in recent years because of economic conditions. California farmers of specialty crops have had an even tougher time because of high interest rates, a sluggish economy, rapidly increasing costs of production, and competition from imports. If we lose the benefits of a dedicated National Weather Service for Agriculture, then protection we are afforded by being able to make sound management decisions, based on accurate weather forecasts, is lost and we are bound to lose many more small farmers.

Just about any of us associated with agriculture can relate stories of asking children where milk comes from and receiving the answer, "From Safeway" for our administration to consider farming a narrow interest makes me wonder if they know where milk comes from.

The Fruit Frost Forecaster in this area represents Stanislaus, San Joaquin and Merced Counties. Our frost-susceptible crops are valued in the millions of dollars. I would like for you to keep in mind that all of our agriculture is affected by the vagaries of weather. I will be telling you how these crops are affected and what farmers can do to reduce their losses, providing they have forecasts of damaging weather.

Aside from the food and fiber consideration, our farmers, who are the original environmentalists, are concerned about the use of pesticides to avoid contaminating water supplies, the air, the soil and the prevention of harmful residues. Only by having accurate weather forecasts with perameters of wind, rain, temperature, dew, etc. can they be successful.

At a University of California seminar for meterologists from throughout the United States at which I was asked to talk about the special needs for forecasting for fruit, nuts and vegetable growers, I was asked the question: "Isn't it enough that you tell the farmers it is going to be cold tomorrow?" My answer, which was supported by the agricultural meterologists, was that the farmers needed to know how cold it was going to get, when it was going to be at the coldest, whether the drop in temperature would be steady or sporadic, whether there would be wind, breeze or drift, the velocity and direction of air movement, whether there would be high or low inversions, what the dew point was, whether there would be cloud cover and even, the density of the cloud cover. Our Fruit Frost Forecasters do give us this kind of information and, as I will relate to you later, having this information has made it possible for our growers to save hundreds of millions of dollars.

The weatherman who asked that question was from a non-farming area. I appreciate being able to come before this important committee. The agricultural community is a narrow interest group, but that interest is to continue to put before the American public the least costly, highest quality food anywhere in the world.

Let me take you through the calendar, telling you how we rely on the National Weather Service for Agriculture.

CALENDAR:

January -- spraying dormant sprays, pruning, land leveling, planting, burning brush and stubble.

February -- frost, planting, pruning, disease and insect control, burning brush and stubble, harvesting leafy greens.

March -- frost, planting, pruning, disease and insect control, fumigating, burning brush and stubble, harvesting.

April -- frost, disease and insect control, burning, planting, harvesting.

May -- dew, frost control, disease and insect control, burning brush, planting, harvesting alfalfa, irrigating.

June -- dew, irrigating, animal stress, planting, disease and insect control, Integrated Pest Management, harvesting, alfalfa, Boysenberries, plums, apricots and cherries

July -- dew, irrigating, harvesting, alfalfa, apricots, nectarines, plums, Integrated Pest Management, pruning, cane berries, insect and disease control.

August -- harvesting, dew, dehydrating walnuts, tomatoes, peaches, nectarines, Integrated Pest Management, irrigating, planting strawberries.

September -- dehydrating walnuts, harvesting peaches, almonds, grapes, rain?

October -- harvesting almonds, corn, grapes, rain, dew, dehydrating walnuts.

November -- harvesting corn, soil leveling, pruning.

December -- pruning and burning.

How the farmer uses the weather forecast.

Most of you are not farmers. I am sure you have some question in your mind as to what I am talking about when I state such items as pruning or land leveling are weather concerns. Let me now tell you of the importance of these concerns and how the farmer uses the forecast to make management decisions.

Frost Much of the knowledge we have about how to protect our crops against frost is fairly recent. This knowledge was developed in Stanislaus County by farm advisors. The type of frost that we have is radiant frost, which means that the heat radiates from the soil or plant parts until the plant parts are cooled to the point of injury. Orchardists and vineyardists have found that by having the soils moist, smooth and firm they can gain up to 5° F. above soils that are dry, loosely worked or weedy. Thus, knowing that conditions leading to radiant freeze are about to occur, the farmer can mow the weeds, avoid cultivation and, most importantly, apply water to the soil. I cannot emphasize enough here the importance of having accurate, timely forecasts of temperature, dew points and wind conditions.

Burning Burning can be divided into two areas: stubble burning and pruning burning. Stubble is the burning-off of the straw from growing the various cereal grains to prevent disease and facilitate tilling the soil for the next crop. Burning stubble under poor wind conditions creates poor visibility through pollutants in the air. For victims of emphysema and other breathing difficulties, the smoke can be actually dangerous. Having accurate, timely forecasts of wind conditions make it possible for farmers to plan their burning under conditions in which there is rapid burning and better mixing of the air, thus a reduction in pollutants. Burning prunings of trees is done because the material is too heavy to work into the soil and must be disposed of by burning. Presently, the University of California is doing a great deal of research on using the prunings for biomass energy generation. However, economic means to do this have not fully developed and farmers must have forecasts on rain and wind conditions in order to facilitate the removal of these prunings.

Leveling soils The soils are mostly loams and sandy loams in Stanislaus County. Working them wet does irreparable damage. We have a saying in our office, "The soils are totally unforgiving." The soil leveling equipment is very heavy. If used on soils which are wet, the water penetration and tillage of the soil can be destroyed. When these soils are worked dry, the wind erosion becomes an expensive factor to consider. The farmer and the land leveler must have accurate forecasts of wind and rain in order to make management decisions.

Disease control The farmer recognizes that pesticides are dangerous and very expensive. For this reason, Integrated Pest Management (IPM) is being quickly adopted. In IPM the various factors of biological control and climatological perameters are integrated to not only give the best control of pests, but to avoid polluting the air, water and soil and to save the farmer money. These savings would be passed on to the consumer.

A good example of how our farmers use IPM is in the control of powdery mildew. Powdery mildew is a devastating disease of grapes. It grows between 54° F. and 94° F., with the ideal temperature for its growth being 78°. This gives us probabilities of occurrence. Through the use of the computer, these have been indexed. Each day the weather forecaster reports to the growers the index for that day. Thus, a grower, instead of having to dust every seven days, as was the former recommendation, can now space the intervals into three or four weeks, if that kind of weather prevails. In my own little vineyard, for example, using the Powdery Mildew Index I used as little as six dustings in 1982 and the next year, in order to achieve the same control, I had to use fifteen. The savings to our growers adds up to hundreds of thousands of dollars.

I won't bore you with charts and tables. Almond production for the state has varied from 600 pounds per acre to 1,250. This vast difference is directly associated with rain during bloom. Having accurate forecasts of rain and temperature during bloom makes it possible for almond growers to apply fungicides for the control of disease which destroys the bloom.

Insect control Our farmers use IPM to control insects. Research at the University of California is determining how weather affects maturity and egg deposition of various insects. The weather information is disseminated to the growers so that they can determine the best time to treat. Many times in the past I have known growers who have treated two or three times for a pest simply because they lacked the information necessary to target the most effective treatment time. To have not treated would have meant a total loss of crop. Through computerized weather collection stations and a dedicated weather station for agriculture, farmers are saving vast amounts of money, are doing far less polluting and are protecting crops which are more wholesome and higher in quality than ever.

Irrigation Our county would be a desert if it were not for the precious water stored in reservoirs from the run-off of the Sierras and used to irrigate the agricultural lands. The National Weather Service for Agriculture has been most helpful in supplying us with climatological data which allows the farmers to make decisions regarding the best timing for irrigation. This allows for noteworthy conservation of this natural resource which is becoming more and more scarce as our population increases.

Harvesting It is during harvesting that the benefits of accurate, timely forecasts are so important. Under state law, if you contract for people to work on your farm and inclement weather occurs so that they cannot work, they must still be paid for a one-half day's work, even though nothing was done. For this one reason alone, it is easy to see the importance of having accurate weather forecasting.

As the fruits soften at harvest time, this is the most susceptible stage for disease. Disease control is mostly a matter of prevention. The fungicides must be applied before the weather conditions conducive to disease occur. Many times in my career as a farm advisor (county agent) the National Weather Service for Agriculture has issued special warnings of impending rain so that farmers could order their spray equipment or airplanes in order to protect their crops. These warnings have resulted in savings to our fruit industry of millions of dollars. I have seen and can relate instances to you where this effort was truly related to the price that consumers paid for both fresh and canned fruits.

Planting Planting of row crops is a tricky business. If rain occurs too soon after the crop is planted, many of our soils crust-over so that the seed will not germinate or the new little plants cannot emerge. Therefore, rain forecasts are very important. Also of great importance is that seed planted in soil that is too cool will not germinate properly. The National Weather Service for Agriculture reports soil temperature in the spring as one of the factors necessary to sound management decisions.

What our local growers are doing

Our local growers have a weather reporting service that is rather unique. There were several factors that prompted the actions they have taken, including having the Reagan Administration state that users should be payers. They took note of this and started the present system of gathering and disseminating weather data. I want to emphasize at this point, however, that without the dedication and concern of the National Weather Service for Agriculture at Riverside, their efforts would be nil. A survey has indicated that to get the same degree of useable information would be prohibitively expensive for our small farmers if we were to go a private route. In total, our local growers have spent in excess of $150,000 for the weather gathering data being used. The weather in the Stanislaus and Merced Counties comes through the San Joaquin Delta to the north and then spreads down the east and west sides of the valley. With the aid of the National Weather Service Meterologist eleven computerized weather stations were placed throughout this three-county area of San Joaquin, Stanislaus and Merced. These stations record for 24 hours the wind direction and velocity, soil temperature, two elevations of air temperature and the humidity. The National Weather Service accesses these weather stations through their computers and uses it in formulating the weather forecasts. Throughout the year they are in close contact with the Cooperative Extension office as to what is going on agriculturally so that they can stress making forecasts that will cover the activities. For example, just a few weeks ago we experienced temperatures in excess of 100° F. Seeing this on the way, the forecaster suggested that turkey and chicken growers should commence cooling the birds. A quick survey by me showed that the poultry people had taken the warning and had installed sprinklers on the roofs of the houses. I didn't hear of one report of bird loss. In years past when this had occured I could have predicted we would have lost millions of birds. In addition to establishing the computerized weather stations the Farm Bureau through their grape section, established a telephone service at the Cooperative Extension office whereby farmer-subscribers can phone in at any time of the day or night and get the latest forecast. During critical times in which rain or frost is predicted, the weather forecasters have conscientiously upgraded their forecasts at short enough intervals that the farmers can make management decisions leading to prevention of losses of commodities and to the reduction in the amount of spray materials they have had to use.

Private Sector Weather Forecasting

Could the private sector provide us with adequate weather information? Our farmers don't think so. Surveys locally indicate that the few large farms we have in our three-county area are the only ones that would use it.

Our farmers are concerned that if the private organization went broke and folded, they would be left without any agricultural forecast. For the government to re-establish a weather service would be terribly expensive.

Locally, my constituents feel that a high-quality, economical food supply is a function of the Federal government.

Further surveys by the Grape Improvement Association of Stanislaus County indicated that private sector weather forecasting is dependent on rather expensive microcomputers and software economically available only to the wealthiest farmers.

Conclusion

Gentlemen, let me remind you that in the next sixteen years the world will gain an additional billion mouths to feed and in only a few short years beyond that -- possibly five -- another billion.

Earl Butz, former Secretary of Agriculture, stated, just before he left office, "In the next twenty years, we are going to have to learn to grow more food than has been produced since the beginning of the history of man." Believe me -- part of that learning will be how climate affects our agriculture and then making use of the knowledge.

Presently, the blue collar worker spends less than 15% of his take-home pay for food for his family. With my close contact with the farming community, I can assure you that part of this enviable position is through the sacrifice of our farmers. Do not ask more of them by taking away the National Weather Service for Agriculture.

* * * *

SUMMARY

Paul D. LaVine testimony
DORFA and NRARE hearings on National Agricultural Weather Operations June 27, 1984

The Administration's view that the National Weather Service for Agriculture is directed to a narrow interest group is an erroneous one. The farmers I work with have a need for accurate weather forecasts the year-around. Without these forecasts delivered by dedicated meterologists with interests in agriculture, farmers are deprived of making management decisions so important in agriculture today.

I can speak with authority when I say that many of our farmers because of economic conditions are going broke -- only one mistake related to the weather that would reduce their crop and they are "done for".

Just about any of us associated with agriculture can relate stories of asking children where milk comes from and receiving the answer, "From Safeway", for our administration to consider farming a narrow interest makes me wonder if they know where milk comes from.

Aside from the food and fiber consideration, our farmers, who are the original environmentalists, are concerned about the use of pesticides to avoid contaminating water supplies, the air, the soil and the prevention of harmful residues. Only by having accurate weather forecasts with perameters of wind, rain, temperature, dew, etc. can they be successful.

Our local farmers have banded together and purchased eleven computerized weather collecting stations, a computer to access them and a printer.

The National Weather Service for Agriculture office at Riverside accesses information from the computer stations, combines it with information from three "Green Thumbers" in our county and with the satellite pictures puts these forecasts on a telephone-recorder. The farmers-subscribers can call the telephone-recorder at any time and get a weather forecast to help them in their management decisions.

The equipment is paid for through subscription to the phone service. It costs, presently, only $25 per year for the daily forecast which includes a three-day and a five-day outlook.

Agriculture generates in excess of 750 million dollars at the farm gate in Stanislaus County. Our subscribers represent just about every crop we grow as at sometime there are weather facts in the daily report for some phase of farming.

Interestingly, we have surveyed the use of private forecasters and find that, in the present economic climate, they would be prohibitively expensive. We are concerned that, if the National Weather Service is dropped in favor of private industry and this private industry cannot make a profit, then we would be left without any forecast. If that happens, the small, family-owned farm, which makes up more than 90% of the farming in our county, will become a thing of the past.

Gentlemen, let me remind you again that in the next sixteen years the world will gain an additional billion mouths to feed and in only a few, short years beyond that -- possibly five -- another billion.

Earl Butz, former Secretary of Agriculture, stated, just before he left office, "In the next twenty years, we are going to have to learn to grow more food than has been produced since the beginning of the history of man."

Believe me -- part of that learning will be how climate affects our agriculture and then making use of the knowledge.

Presently, the blue collar worker spends less than 15% of his take-home pay for food for his family. With my close contact with the farming community, I can assure you that part of this enviable position is through the sacrifice of our farmers. Do not ask more of them by taking away the National Weather Service for Agriculture.

Biographical Sketch

Paul D. LaVine
Born in Los Angeles, California
Attended Kindergarten through 12th grade in schools in Los Angeles
Spent four years in the United States Navy

Education

Received B.S. degree from New Mexico State University in Horticulture in 1950
Received M.S. degree from Oklahoma State University in Horticulture in 1952
Did Graduate work for credit at Colorado State University, Oregon State University, University of California at Davis and Riverside

Career

Attended Oklahoma State University on teaching fellowship 1950-52
Experiment Station Horticulture New Mexico State University 1952-54

University of California Cooperation Extension Farm Advisor
Modesto, California 1954 to 1981

University of California Cooperative Extension County Director
Modesto, California 1981 to present

Contributions

Have written and published numerous articles about Ornamental Horticulture, Grapes, Cane Berries and Weatner

Organizations

Rotary International
Free and Accepted Masons
Member of American Society of Enology and Viticulture
Member of American Society of Horticulturists
Grape Improvement Association
Farm Bureau Gold Member
Honorary Member of Future Farmers of America
California Association of Farm Advisors
Alpha Gamma Rho

Military Service

United States Navy 1942 - 1946
Quartermaster 1/C
Good conduct medal, American Theater Victory, European African
Middle Eastern area, Asiatic Pacific (3) stars Ribbons, Purple Heart

Mr. **Brown**. Thank you very much, Mr. LaVine, for that excellent testimony.

Let me call on Mr. Gunderson first for any questions he may have.

Mr. **Gunderson**. Thank you, Mr. Chairman, and I would like to thank all of you for your testimony and your statements.

You, Mr. LaVine, really hit the question that I must sit here and contemplate as I listen to all of your testimony, because it is the problem of where do you get the information.

I would be interested, first and foremost, in knowing how most of you achieve your weather information. Is it through a subscriber service? Is it through the electronic media, through the newspapers? Generally, where do you get your weather information, personally, in your own farm operations?

Mr. **LaVine**. Let me start out, if you would.

In our area, during the months from February 14 to May 14, the National Weather Fruit Forecaster is stationed in our county, and this goes back 60 years. When he is there, then we get the information by radio and through our subscriber telephone.

The reason we went to the subscriber telephone is because radio comes on only at certain times. If you are called away due to maybe a call of nature or the telephone ringing or something, and you miss that forecast on a night when frost is being forecast, then you just sit there and worry and hope, or call up a neighbor and ask, What did the weather man say? So we went to this telephone, which has really proven to be a boon in spite of the cheapskates. Now a farmer can call at any time after 3 o'clock in the afternoon and find out what the weather is going to be the next day. These men are really dedicated. When we are having critical weather—rain forecast or strong winds or frost—they give us an update every 2 or 3 hours, which has proven to be of tremendous value to us.

Mr. **Flowers**. In Mississippi, it goes over educational television stations; also on the local radio stations. They call the weather station at Stoneville to get this information. It also goes to Lousiana, Arkansas, and Mississippi from Stoneville. It is also on these—I don't know what you call them—these little weather radios where you punch a button and get the weather. The agriculture weather is given over those little radios, too.

Ms. **Harner**. Ours is basically the same way. It is put on television, local channels. It is on the radio, advertisements during certain times of the day. We also have a telephone line that goes into the Department of Agriculture where they can dial the phone and get the National Weather Services information.

Mr. **French**. That is pretty much the same way as in Florida. We depend on the electronic media primarily for the early warning alerts, but the Weather Service provides a telephone system where you can call in and get details, updates every 2 hours, and many of the county extension agents provide that information, or repeat that information on a local basis to local users.

Mr. **Gunderson**. Recognizing that the electronic media deals with listener surveys which are most important in determining what they are going to be able to charge for the advertising rates, that type of thing, do you not assume that if the service were not provided by the Federal Government because the demand is there, that the various electronic media in your area would respond to this listener demand by providing this service?

Mr. **French**. We have explored that quite thoroughly with the media in our State. The primary difficulty is that the bulletins that are issued by the Weather Service are quite technical. The electronic media, commercial media, invariably want to edit it and make it more appealing to a general audience. In Florida, they are much more concerned with giving the surfing conditions and whether or not it is going to be sunny on the beaches than they are referring to agricultural weather.

So we simply have not found that that is an acceptable thing. It is good for an early alert. It can alert everybody across the State very quickly that there is a severe problem coming, but when you need the detailed information, then you need to get the real technical stuff.

Mr. **Gunderson**. You have no radio stations in Florida that are generally according the farm audience? I mean, in Wisconsin, I could name you—for example, in my district—two stations that are farm stations. Those are the stations the farmers listen to. They are predominant in farm news; they are predominant in farm weather reports. They make their money geared toward that particular audience. Are there no such stations in Florida?

Mr. **French**. Oh, yes; we have several that do that, but I would say that they only cover maybe 25 percent of the area of the State.

Mr. **Gunderson**. All right. Any other comments from the panel?

Mr. **LaVine**. Yes; I would like to comment just with a story that I heard from a man from Iowa, incidentally. He was saying that the computer broke down at Iowa State University. They couldn't give out the weather, and so they went to this old Indian and asked him, and he said, "It's going to be a very hard winter." And they said, "Well, how do you know?" And he said, "White man put up storm windows early." [Laughter.] I think this is part of the problem, that the media, unless they have the National Weather Services for agriculture to give us agriculturally related weather, is just not going to cut it. Most of our weather is designed for the skier, the pilot, the motorist, that sort of thing. But we want these parameters of dew and frost and wind and breezes and updrafts and that sort of thing, and that is what we depend on.

Mr. **Gunderson**. Thank you, Mr. Chairman.

Mr. **Brown**. Did you have something to say, Ms. Harner?

Ms. **Harner**. That is the same situation basically in our area, too. We need the full weather information that they don't give on your television stations.

Mr. **Flowers**. I think it is too important to depend on somebody to pay for it at a radio station, because if he doesn't, we don't get the weather, and it ought to be given out free.

Mr. **Brown**. It seems to be related to the fact that farmers are so efficient that there are only 2 or 3 percent of them feeding the rest of the population, and the commercial media seems to be geared more to the 97 percent than the 2 or 3 percent, with some laudable exceptions, of course.

Mr. Penny, do you have any questions?

Mr. PENNY. No, Mr. Chairman; I don't have any questions, and it is simply because in each instance their testimony was very thorough and covered the issue very well.

Mr. BROWN. Mr. Evans?

Mr. EVANS of Iowa. No questions, Mr. Chairman.

Mr. BROWN. Mr. Franklin?

Mr. FRANKLIN. I do have one question of Mr. Flowers, Mr. Chairman.

First, I want to thank this panel for the excellent testimony that has been given today.

Dick, I would like for you, if you would, to tell us about one of the very practical things that our Weather Service does in conjunction with our fine land-grant institution, Mississippi State, concerning direct beneficial help to farmers in the rice program, the DD-50 Program. Would you explain that, how it works and what practical effect it has for rice farmers?

Mr. FLOWERS. I am not a rice farmer, myself.

Mr. Morgan, do you know exactly how that works?

Mr. MORGAN. Yes.

Mr. FLOWERS. Mr. Morgan will explain it in detail.

Mr. MORGAN. Congressman Franklin, the DD-50 Program, which was established for rice, starts off through cooperative effort with the extension service, and from the time rice is planted until it emerges as a plant, through each day, the rice farmer can contact the Agricultural Weather Service at Stoneville from the mid-South area, and through the Agricultural Weather Service, they can tell these farmers, these rice farmers, when they should apply herbicides or any other type of pesticide insofar as the growth of that plant based on the weather pattern in that area from degree day 1 to degree day 50, which usually will get the farmer into the area where he has a safe harvest time and should have a fully mature plant and have the right application at the accurate time.

Mr. FRANKLIN. How has this been utilized by those rice farmers since this program has been instituted? Is it pretty widely used?

Mr. MORGAN. There are more than 350,000 acres of rice in a three-State area currently enlisted in the program, and it has accrued tremendous benefits already in terms of dollar value in reduced losses of these applications and in increased yield.

Mr. FRANKLIN. Is there any attempt or initiative on the part of the weather station at Stoneville or the extension service or Mississippi State in trying to expand this DD-50 Program, which was specifically designed for rice, to the other crop commodities that we have in the general area that Stoneville serves?

Mr. MORGAN. There is one other program that was established last year. It is a DD Program for cotton. It is going through experimental stages now, but it has already shown tremendous promise, and we have tripled the enlistment of cotton farmers in that program in a 12-month period.

Mr. FRANKLIN. Thank you.

Thank you, Mr. Chairman. That is all I have.

Mr. BROWN. Mr. Flowers, I very much appreciated your testimony because it contained so many specific examples of the kinds of economies that result from having good weather services on the various crops in your area.

How long have you had this regional weather facility there at Stoneville?

Mr. FLOWERS. Since 1958.

Mr. BROWN. Since 1958?

Mr. FLOWERS. It was No. 1.

Mr. BROWN. And that works closely with the Ag Research?

Mr. FLOWERS. It is in the same building with the State agriculture research, and the Federal is right across the street.

Mr. BROWN. Now, there are only four of those centers currently, according to your testimony, around the country.

Mr. FLOWERS. That is right.

Mr. BROWN. Of course, I don't want to be too parochial, but I wonder why we don't have one in California. [Laughter.]

Mr. LAVINE. Well, I think, Mr. Brown, it is primarily because our agriculture—as you know, farming there—varies within just a few miles. In our county, we have something like 70 commercial crops, and I think this is part of the problem of having a station like that. They will deal primarily with rice or corn or cotton, and they don't have this diversity that would cause problems in California.

Mr. BROWN. I don't want to make too blanket a statement, but it would be doubtful if most of those 70 would have the dollar value that the cotton would have in the delta, for example, or rice or something of that sort.

Ms. HARNER. Mr. Chairman, I believe that there have been 12 planned over the country, and California was supposed to have 1, but the Department of Commerce has started backing off on it.

Mr. BROWN. Uh-huh. [Laughter.]

Mr. FRANKLIN. If I may, Mr. Chairman, interrupt you, in that I understand the seniority program here in Congress, I would like to put my pitch in to you that there are only going to be four; and I certainly would not like for you to remove the one from Mississippi to California. Please go somewhere else. [Laughter.]

Mr. BROWN. Let's talk about that. [Laughter.]

Well, we have some additional questions, but we probably should move ahead with the next panel this morning. If we need the additional information, we would like to submit the questions in writing and hope that you will be able to help us with written answers to some of these questions.

Thank you very much for your excellent testimony this morning. We very much appreciate it.

Our next panel will represent the private sector agriculture weather producers and includes Dr. Dick Felch, who is an agricultural meteorologist with Control Data Corp.; Dr. Rolland Hauser, technical director for Nowcasting, Inc.; Mr. David Skoloda, vice president of Agri-Data Resources. Would these gentlemen all come up to the table, please?

It is just coincidental that the witnesses are from Minnesota, California, and Mississippi on these panels this morning. We happen to have the best witnesses from those States. You are from Minnesota, aren't you, Dr. Felch?

Mr. FELCH. Right.

Mr. BROWN. We have had many, many opportunities to take advantage of expertise at CDC, but I honestly did not realize that you were into the ag weather business, and we are very pleased to have you here this morning. You may present your statement first and then the others in turn.

STATEMENT OF DR. RICHARD E. FELCH, SENIOR CONSULTANT, AGROMETEOROLOGY, CONTROL DATA CORP.

Mr. FELCH. Thank you, Mr. Chairman. It is indeed a real pleasure to be here and to testify before this committee, and particularly to address the role of the private sector in agricultural weather. In the testimony this morning, I feel, all of a sudden, that the burden is much heavier on my shoulders than when I walked in this morning. The National Agriculture Weather Program, from a Government perspective, has basically been stagnant for the last 10 to 15 years, since, I believe, that last formal 5-year plan that was prepared for our National Agriculture Weather Program—which, I believe, did include programs for California—was approved in 1969. That program was redrafted in 1974, and that draft is still being bantered around between the Department of Agriculture and the Department of Commerce. The result of this period has been a feeling of frustration and almost operation in a survival mode as far as the National Weather Services Program is concerned. I might just interject at this point that I have had the opportunity to work on that side of the fence as well, having been with the National Weather Service for several years before joining Control Data Corp. Most of the new activities that we have heard about and will continue to hear about today and tomorrow have resulted from the creativity of either the existing National Weather Service staff or the States that they support. The private sector has in fact taken a very limited role in agricultural weather. I believe, personally, that there are a number of reasons for that. What I would like to do this morning is just to very briefly summarize four of those for you. The first has been a problem of lack of program direction on either the part of the Department of Commerce or the Department of Agriculture. The private sector doesn't really know whether we can collaborate with the existing programs or in fact we are competitors with them. The second issue is the one of, is there in fact a proven market. There was mentioned this morning the concern about whether or not farmers would pay for this service, and as the private sector, we are in this to make a profit. The third point is the question of the collection and analysis of basic information versus the tailored information networks that are beginning to develop in many States. And, finally, there is the basic issue of providing basic services versus the very tailored or special services, what we would call value added, that have a particular significance probably for a limited audience and might provide a very excellent market for the private sector.

The first issue as far as collaborator versus competitor, essentially, the private sector has been kept in limbo in terms of where we can play an effective role. To develop an agriculture weather service takes a lot of money, personnel, and general effort, and so as we look at it from a business perspective, we say to ourselves, Well, is there really a good opportunity there? And there are a lot of questions around that.

From a technology standpoint, there is no question in my own mind that the private sector could do the job. The question more is, though, can we do it most cost effectively for the Nation's farmers?

In addition to providing basic ag weather services, I believe the private sector can play a tremendous role in the supporting technologies. We have seen tremendous strides in the use of microcomputers and communication networks, in satellite imagery, the ability to virtually provide a farmer a constant flow of information. All those technologies are there. The key is the program that can put it together and make it work.

As far as the issue of the marketplace, this is a very real problem. In the recent activities related to LandSat, for example, one of the key issues that was raised by many companies was, is there a reasonable market out there, people who will buy the services that would be provided, at a cost which would allow us to make a profit?

There have been a number of studies in the last 5 to 7 years that have polled farmers' opinions in terms of what they would pay. There was a study published in about 1982, I believe, in the American Meteorological Society's Bulletin, which polled a series of Wisconsin farmers. They went around to a series of county fairs, showed farmers weather information and asked them a series of questions. The general consensus was that they would pay maybe a little bit, but most of them wouldn't pay anything.

I believe the problem lies in the fact that despite some of the success stories we are hearing, farmers in general have still not learned how to effectively use farm information. Whether it be in a national agriculture weather program or in a private sector program, this is going to be a key facet.

We may even, in some areas, have been guilty of teaching farmers how to get along with very little or no information over the last 20 years.

Another key point related to marketability, as I have said earlier, is the issue of profitability. I do not say that to be facetious. In my many hats that I wear with Control Data, I have had an opportunity to interact with a number of Government and State programs related to services, and primarily on the climate and agricultural weather side. There appears to be a conception that the private sector involvement is one of what can we give them, what can we do for them, rather than working on it as a partnership.

When we invest in activities—and Control Data has invested in a number of these kinds of programs—we, in the long term, are looking for some very tangible financial benefits.

My own personal opinion is that the adoption of a federally supported agriculture weather program as we are talking about this morning will in fact be very helpful and beneficial to the private sector. I believe, through such a program, we can accomplish the educational program. The result of that educational program will be an increased understanding of what they can do with weather data. When they understand that, farmers are going to want more and better information, and as the demand grows, then there will be significant opportunities for the private sector:

The third issue is that of basic services. In this area, I am particularly concerned about the fact that even in terms of our general weather information flow from the National Weather Services, each year we are looking there, also, at cutbacks in the programs, the number of stations the data are available from. There are some steps, I do understand, that are being taken to correct some of these deficiencies.

The other thing that is coming out of this is the fact that many States are developing their own agriculture weather information networks to enhance the National Weather Services networks, because they are not adequate to meet their needs.

This can provide one of two scenarios: One, a unique capability which can be used very effectively in agricultural weather; or, two, it can create a major headache in the sense that we are going to have a series of many agricultural weather information networks out there that nobody else can access and that cannot communicate with each other.

And then, finally, the fourth point is that of the private sector's primary involvement being in the value-added side of the house—going after or developing those markets that there is a very high need for, that may be very specialized. They are talking about getting down to the individual farm or area, maybe well beyond what any Federal program could expect to do.

In closing, I would like to just make a couple of brief comments regarding the ARI plan that has been put forward. Most of these basically are my own personal analysis and view of the plan.

First, I believe it does provide a positive basis for the development of a coordinated agricultural weather program. With an established mechanism, the private sector then will have its avenues also to interact with that program. I believe the private sector should be a strong collaborator in any agricultural weather program.

I believe, also, that a mechanism should be established for the active involvement of the private sector in the planning process, not only at the local and regional levels, as discussed in the plan, but also at the national level.

The ARI plan addresses the issue of need for education of farmers. As I said before, this would provide tremendous market opportunities for the private sector. The plan, or any plan that is developed ultimately from the initial ARI plan, must address the issue of basic services, and it also must address the issues of high technology.

High technology can produce a lot of efficiencies in the system, and I would caution, in the development of the program, following the sort of not-invented-here syndrome, the tendency to want to be able to develop your own way of doing things, because you think you have a little bit better idea. The cause or the purpose has to be broader than just an individual State or area.

Thank you, Mr. Chairman, for this opportunity to testify before your committee, and if we can be of any further assistance, we will be happy to help you.

[The prepared statement of Dr. Felch follows:]

AGRICULTURAL WEATHER SERVICES

Richard E. Felch
Senior Consultant, Agrometeorology
Control Data Corporation

Mr. Chairman--I appreciate this opportunity to testify before your subcommittee regarding the need for weather services for agriculture. The past 15 years I have had the opportunity to deal with agricultural weather information services from a state, national, private sector, and international perspective.

The National Agricultural Weather Program of the National Weather Service has been stagnant for over a decade. The last formal five year plan was approved in 1969. The plan was redrafted in 1974 for approval in 1975. That draft is still being bantered around between the Department of Commerce and the Department of Agriculture. During this period the National Agricultural Weather program has been in a "survival mode" with the National Weather Service staff always looking over their shoulder. Although the program has been reorganized to better utilize existing resources, no new monies or staff have been added. Only the ingenuity and creativity of field staff and the States they support have allowed for any new activities.

In the past few years, several states have developed varying level of services. Not-for-profit corporations have been formed in Florida and California. Some for-profit weather service firms are providing information to a limited sector of agricultural producers, with most of the services directed towards agri-business.

In my opinion, the role of the private sector has been limited by several factors. This morning I will address just four:

- o lack of program direction from either DOC or DOA; are we collaborators or competitors.
- o lack of a proven market; will farmers pay a reasonable fee for services from the private sector.
- o high cost of collecting, analyzing and processing basic data; what is role of state and national programs and the private sector.
- o scope and scale of activity; basic services vs value added services.

COLLABORATORS VS. COMPETITORS

The lack of national program direction has kept the private sector in limbo in terms of its potential role in providing agricultural weather services to the nation's farmers. What is the future role of the federal government; the National Weather Service, the State Extension Services, the National Climate Program? Private sector firms can serve as collaborators or competitors in such activities. The role of collaborator is much preferred.

In addition to providing weather information services, the private sector has been actively involved in the development of new technologies which could be utilized in a national agricultural weather information system. The explosion of new technology in microcomputers, communications, image processing, data collection and processing, and graphics has opened up a tremendous number of opportunities. The results of these technologies in weather dissemination are seen daily on the evening news or during severe weather in many areas. These same technologies can be tailored to meet the weather information needs of the farmer The data collected can be used to drive models which provide the producer with guidance on insect and disease development, irrigation management, pesticide and herbicide requirements, the economic benefits of taking various actions, and finally for the safety and well-being of the farmers family.

Satellite weather information provides regular updates of weather conditions. Control Data Corporation has been actively involved in developing image processing technologies. We have also been collaborating with Florida Agricultural Services and Technology(FAST) to develop satellite-based weather information services for agriculture, providing them a CYBER 730 mainframe to handle their data processing and communication needs.

In addition, Control Data Corporation offers crop production forecasting services , primarily to agribusiness concerns. As a part of that service we also offer the weather data which we use to drive our production forecasting models. Our data set consists of estimated values for seven different weather parameters at the county or crop reporting district level.

WHAT IS THE MARKET?

Policy in recent years has moved towards having the private sector take over the responsibility for providing tailored services. The recent activities with the LANDSAT program has shown that many companies are not convinced that such activities will be profitable. Agricultural weather presents the same dilemma. Agricultural information via the Extension Service and weather information from the National Weather Service has generally been available at little or no cost. Farmers have been polled in several studies and the consensus is that some farmers may pay a nominal fee for weather information, but most still expect it to be free. One reason for this attitude is that producers have not been educated about the value of weather information. Farmers have learned to "get-along" with existing information or to ignore what is available. The success stories of the National Agricultural Weather Program to date have come from educated producers who knew how to utilize the information available. This educational process has often been accomplished through the joint efforts of the National Weather Service and Extension Service staffs.

The objective of the private sector weather vendor is profitability. The key to profitability is finding a need and filling it. Most private weather firms have focused their efforts on agribusiness simply because there needs were not being met by federal programs, those needs were expressed more clearly, and the value of the information was great enough to justify substantial contracts.. Farmers have represented a limited market, but the potential is still there. In fact, the adoption of a national program plan for agricultural weather information services will be a major step in opening that market to private weather services. As stated earlier, a strong education program is needed for the national program to be effective. As this educational process develops, farmers will demand more complete and reliable information. State and local programs may be limited because they must meet the needs of all producers. The private sector can then provide tailored services beyond the state and local programs. Therefore, the private sector also has significant responsibility in developing and carrying out the educational programs.

BASIC SERVICES

The cost of collecting, analyzing, and processing weather information is high. The National Weather Service spends a major portion of its budget to carry out this task. At the present time this information is available at a reasonable cost, if any. However, this information is collected primarily at airports or in-town locations. The data is not representative of agricultural conditions. A number of States have established their own networks to help overcome this deficiency. However, there is little standardization from one State to another. A frustration of the private sector has been the inaccessability of much this data. Farmers can access this data in only a handful of States. At the other extreme, Florida is providing complete satellite coverage every thirty minutes to farmers with their own microcomputers.

Any new agricultural weather services program must provide a mechanism for coordinating the collection and distribution of agricultural weather observations. This data must be readily available to national, state and private sector users. There are a wide range of technologies available for data collection and dissemination. The problems of incompatability between equipment is improving, but there is still a need for standards in observations and storage. We need to avoid the "not-invented here"syndrome. In some cases equipment and programs will have to revamped; in others there is no existing systems and one will have to be developed from scratch. Any legislation that is develop should consider some initial "start-up" costs.

THE CONCEPT OF VALUE-ADDED SERVICES

There is a need for a wide range of basic services such as provided by the National Weather Service Agricultural Weather Service program today. The information provided to the agricultural producer is generalized by area and activity. The producer must make his own interpretation relative to his operation. For many producers this level of service is adequate. However, those with operations which are highly sensitive to weather will require additional services, particularly as producers learn how to use the information. The level of information must to refined down to the immediate surrounding area, or even his own farm. He may have consultants to advise him on a wide range of problems. The value of the information may be great enough to warrant a substantial investment in such services. This is the role of the private sector. The consultant or weather service company takes the basic information provided and adds value to that information.

THE ARI PLAN AND THE PRIVATE SECTOR

The Agricultural Research Institute's Panel for Agricultural Meteorology has proposed a plan for a coordinated Federal and State effort to ensure that adequate services will be provided to the Nation's Farmers. From a private sector perspective, the development of a national agricultural weather program based on the ARI report is important to both the industry and the agricultural producer. It would:

- Provide a positive basis for the development of a coordinated national, regional and state/local program, including a mechanism for the private sector to interface with that program. The private sector should be involved at all planning levels, including the national level.

- Provide an educational program for farmers which would demonstrate the value of weather information to agricultural operations. This would provide market opportunities for the private sector to supply value-added services that go beyond the basic services program;

- Insure the continuation of basic data services from the National Weather Services within their guidelines for specialized services; allow for the integration and coordination of specialized data bases for agricultural operations. The proposed plan also considers the need for the rapid collection and dissemination of data;

- Allow the introduction of high technology applications in data collection, processing, and communication; support of management tools, resource optimization, satellite weather imagery, and marketing information.

SUMMARY

Agricultural weather services are important to the well-being of our agricultural producers and the nation as a whole. The proposed plan of the Agricultural Research Institute provides a framework for developing an effective, coordinated and comprehensive agricultural weather services program. The private sector weather service firm can support be an active partner in the development of the program. A requirement for that involvement will be an active role in the planning processes at all levels.

Mr. BROWN. Thank you very much, Dr. Felch. Your statement will be very helpful to us.

Would you go ahead, Dr. Hauser?

STATEMENT OF DR. ROLLAND K. HAUSER, TECHNICAL DIRECTOR, NOWCASTING, INC.

Dr. HAUSER. Thank you.

My name is Rolland Hauser. I am a resident of Chico, CA.

It is a distinct honor and privilege to appear before you today. First, let me briefly describe the organization I serve as technical director.

Nowcasting, Incorporated, and its operational arm called Cal Ag Weather have grown from work which began in January 1979. A group of northern California agricultural interests, mainly orchardists, decided for themselves that Federal budgets for local ag weather services were very unlikely to increase. They felt an increase in the budget by a factor of 3 to 10 times would be necessary if the Federal Government were to provide the degree of free ag weather and climate support they need for survival in the economic, social and political climate of the eighties and nineties. They felt self-help at the grass-roots level was needed.

Our work began as a research and development project under the auspices of The University Foundation of California State University, Chico. On July 1, 1981, a nonprofit corporation was formed to perform educational and scientific functions related to this topic. In early 1982, a subsidiary, Cal Ag Weather, was created to deliver local ag weather services on a routine basis. Nowcasting's board of directors are prominent California agribusinessmen. They have chosen an organizational framework which is modeled after the California Farm Bureau Federation. I present this testimony as a representative of these California growers.

Our goal is to provide services year-round and in a very site-specific and commodity-specific manner. We supply complete one-stop ag weather service wherever this service is desired. That includes the relay of important National Weather Services ag weather products. It is not our goal to replace or threaten in any way the extremely valuable but more generalized ag weather services provided by the National Weather Service. In fact our perfect world would be one of intimate interaction between Cal Ag Weather employees and both National Weather Services and Cooperative Extension Service field personnel at the local level. We know that California agriculture would benefit from this kind of public-private partnership. We believe these benefits would apply throughout the Nation.

I have sent written copies of my remarks and some supporting material to Mr. Jack Fellows of the chairman's congressional office. It is my intent that these materials be included in the written record of the hearing and that they serve as additional background for any questions you may have. I call your particular attention to the remarks of a California grower, Mr. Robert D. Hennigan, Jr., who presented a keynote speech recently on agricultural weather information packages.

Mr. BROWN. Without objection, that additional material will be included in the record at this point.

[Material to be supplied follows:]

SPEECH PRESENTED

to

WORKSHOP on WEATHER INFORMATION PACKAGES

for USE in ON-FARM OPERATIONS

co-sponsored by: The W. K. Kellogg Foundation
California State University, Chico
California Department of Food and Agriculture

held at Chico, California, May 22-23, 1984

Robert D. Hennigan, Jr.
California Orchardist

Robert D. Hennigan, Jr. 5/22/84

I am happy and honored to be here tonight, although I must admit that I was surprised to see by the program that I am one of the "featured" speakers. I was led to believe by Dr. Hauser that I was just to come and say a few words about weather from the point of view of a local farmer -- no mention was made of a "featured" speech.

I guess I am what you would call a token farmer at this meeting. My father started farming as a farmhand in 1918 at the same location at which my son and I now farm. He subsequently became a renter and then acquired the property and we have added a bit to it. My grandfather and great-grandfather were both farmers in this county. We are almost exclusively in the almond business at this time.

Farmers, as you appreciate, are completely involved with and dependent on the weather and have learned that they sometimes can profit by understanding more about what is taking place in their environment. They also know that, to a very limited extent, they can sometimes change their local conditions, as we ourselves do in temperature control with sprinklers or fans. To do any of these things, however, we must first have the insight and the data that the meteorologist can give us. By far the greatest contribution that the meteorologist can give is a forecast of what to expect -- today, tonight, tomorrow -- the rest of the week. It would be beautiful to have a forecast for next week, next month and next season, but a farmer begins to doubt the meteorologist's credibility when he gets that far out.

Thinking back over some of my experiences, I recall when I was in the hay business. In this area, we have to let the hay dry until we get the stem moisture down to a point where it will keep without molding, but by that time the leaves and the rest of the plant are tinder dry, so then we wait for dew before baling. In order to determine when the hay was ready, I would get up every hour after midnight and go out to see if there was dew on the hood of my pickup. I now have a young neighbor who is in the hay business, and he has a sling psycrometer and a frost alarm. Before bedtime he determines the dew point and then sets his frost alarm to that temperature. When the alarm goes off he knows the dew has arrived. He has learned something from the meteorologist that has improved his life and his efficiency a great deal.

I have another neighbor who is in the beef cattle business. His family pastures their animals in the foothills east of the valley. Because of a falacious policy on the part of the Forest Service people, two or three generations went by during which no brush burning was allowed on this ground. As a result, the brush has grown up and eliminated much of the grass and browse that was orininally there -- decreasing the carrying capacity of the ground. Five years ago this policy was finally reversed and a cooperative program set up between ranchers and the state and federal people to try controlled burning there. It is a continuing program that is still going on. I was involved in the first and later burns and the government people were almost as inexperienced as we were. Their meteorologist gave the word to start the first burn on an August afternoon at about 5 p.m. It was 105°F, 11% humidity, and we had 6 MPH winds. In less than two minutes the fire was over the fire line and out of control. It burned down into Deer Creek Canyon (about 2,000 feet deep -- very rugged) and it was hand crews and shovels. It looked hopeless and overwhelming, covering several hundred acres by about 2 a.m. when the fire died a natural death. The humidity had suddenly come up so much that the material was no longer combustible. Both the meteorologists and the cowboys learned a lot of lessons that night and in the ensuing years. We have learned mutual respect and, above all, the importance of good weather information and forecasts. We have found that through the proper use of good information we can safely and economically carry out these large operations (6,000-10,000 acres) as well as fine-tune the operation so as to keep the smoke in the valley to a minimum.

As a dry-bean farmer, I had many weather-related decisions to make as we approached harvest time. Before you cut the plants the wind can't blow them around and maybe out of the field, shelling them out in the process, so you have to outguess the wind. The soil in my area gets very sticky when it is wet, and, if the foliage covers the ground, it may never dry out enough to work in the field after a rain in October or November. The other consideration is that green beans will dry faster before they are cut than after, so the bean farmer has to outguess the rain. He also has to outguess the rain when the harvester arrives because the sun will dry the beans much quicker and more cheaply than a crop dryer, even if he has one, but a wrong guess can lose his crop completely. Other farmers have the same or similar choices.

Most of the working decisions that a farmer makes involve immediate weather. Is it going to rain? Is the wind going to blow this afternoon? Should I call out the crews to spray tonight or will it be too windy? If I spray, will the rain come and wash off the material before it is absorbed into the leaves? Should I windrow the nuts so we can pick them up tomorrow or should I leave them scattered because it is going to rain tonight? Is there going to be enough suitable weather to spray by ground rig or should I call the helicopter?

I'll try to talk about some of the things I've heard today from a farmer's vantage point.

Do we in agriculture need "better" weather support? Yes. Do we need weather information and forecasts which apply better to our own local areas? Yes. Do we need our weather information services updated frequently, especially when the weather is changing rapidly or the forecast has gone wrong? Yes. Friday's recording on a three-day holiday just doesn't make it. Do we want our own personal weatherman in our own local community so that we can get to know his ways and so that we can talk to him when a decision gets particularly crucial for us? Yes. And do we want to have all this for free? Of course.

But is it realistic for us to expect all our wants to be fulfilled? That's not how the world works.

Will we pay for our weather information? Well, we pay for it already. We pay our taxes just like city people do, and we pay our share of the advertising that supports the night-time news and day-time entertainment, but our on-farm use of weather information is becoming rapidly more sophisticated than either the tax collector or the media news director seems comfortable in dealing with.

We hear and read about new agricultural research results that need weather support. The Extension Farm Advisor makes sure we have opportunities to hear and read about the new techniques, but by and large most farmers aren't making full use of them yet. Some of us are trying to use degree days, disease indices and evapo-transpiration units. We are doing this in order to save money by substituting knowledge and intelligence for costly water, chemicals and sprays.

There are times near harvest, pollination and bloom when I would like to check out what the clouds look like over the Pacific, but the TV news isn't on yet or, more likely, I'm not in the house in front of the television set.

Another fact about these especially crucial times of year is that I am very busy! I don't have time to be my own weather man; nor do I want to be. In fact, there are a whole lot of specially-trained people whom I employ to help me for more or less the same reasons. I purchase pest control advice, plant nutrition advice and irrigation advice. There just aren't enough people in the local Extension Service Office to provide me with the degree of free advice that I need, and perhaps it's not right to take tax money to tailor specific recommendations just for my farming operations.

Now that we are speaking of not enough people and not enough money, we hear that some regions of California have already lost some good agricultural weather forecasters to more secure government jobs elsewhere. At the very least, the National Weather Service budget doesn't seem to be expanding to provide a broad new range of agricultural Services.

Will we farmers, then, pay a reasonable price for the weather information we need? There are those of us who will spend a dollar if we are certain we will get a dollar ten or fifteen back, but lurking somewhere in the backs of our minds as we think about self help, is the fear that the Federal Government may give some sort of free service. Certainly no competent businessman is going to go into competition in the marketplace against a free service.

A sensible thing would, therefore, seem to be for the government and the farmer to work together. Can we farmers get the improved weather help we need without building on a foundation of basic Federal Weather Service? No. Are we willing to assist governmental efforts with our own funds? Maybe, provided we have a great deal to say about what is done with our money.

I fear there may be some misconceptions among some of you about how farmers use weather information. First, we have some knowledge and opinions. We know meteorologists are only human and that meteorology is not an exact science, but there is a problem of credibility in spite of all that. General, regional forecasts are inevitably wrong in their details. Airport weather observations generally do not apply to my farm. One concern relates to the questions of how to handle uncertainty and how to provide detailed information. I don't have any clear answers, but the general problem isn't strange to me. After all, I make business judgements in the face of uncertainty every day. When you tell us what you think, don't underestimate our intelligence and experience. Just give us the probabilities and the alternate possibilities, so that we can make appropriate judgements.

Another area of popular misconception concerns the way farmers acquire weather information. When there is a crucial decision to be made in which weather is a factor, we shop around. We try all the radio stations. We watch all the local TV weather. We call the people we know at the local weather station, or the FAA. Hardly any of us gets his weather information directly from the National Weather Service. There is almost always an intermediate person, agency or private firm involved as my direct source of weather information. Yet, when farmers are asked the question: "Where do you get your weather information?", most farmers probably reply, "From the National Weather Service." I think most farmers do not know how the weather business really works.

The last misconception I want to highlight concerns the timeline of my operational decisions on the farm. Yes, I would like perfect five-day, ten-day, thirty-day, seasonal, annual and decade forecasts, but I don't think I can get them. I probably don't have as many planting choices at my disposal as the row-crop farmer does in the San Joaquin. I am not as concerned about drought or flood as a midwestern or southeastern corn or soybean farmer is. I don't play the futures. There isn't even a futures market for almonds.

My long-term decisions concern both the development of new farming land and the rejuvenation of existing farms so that they can become productive once more. These decisions require improvement in climate information and assistance in analyzing the risks involved during the crop periods and the periods of economic return that I happen to be interested in. Picking the right climate is important to me.

My short-term decisions are made day-to-day and hour-to-hour. They concern irrigation; sprays for pests and diseases; the placement and movement of bees; the timing of harvest operations and the movement and handling of the harvested crops; and, last, but far from least, the management of labor teams. The short-term decisions require the best possible weather support for the next few hours out to three days or so.

In summary, I have tried to tell you about the way my life and the weather are tied together. Every farmer's thoughts on this subject are probably different from mine, at least a little bit, but I think most of us would agree on a few points. Keep it affordable, simple and specific to our neighborhood. Make it easily available and current. Don't be too quick to give up on the telephone as a way to reach us. Tell us what you really think is going to happen. If you need help, we may be able to provide some.

We farmers are intrigued by your efforts. We are starting to see ways we can use the results of your hard work. There are some of us who want to help. We are your end users, so don't be afraid to involve us.

11:10 a.m. Discussion among Participants
11:30 a.m. Breakup of audience into Discussion Groups led by Workshop Participants
12:15 p.m. LUNCH
1:15 p.m. Work Groups:
--"What has been tried?"
(Leader Pending)
--"What has worked (not worked)?"
Dr. Alan Murphy,
Oregon State University
--"What are the unit costs?"
Dr. Al Weiss
2:45 p.m. COFFEE BREAK
3:00 p.m. Work Group Reports: "Workshop Wrap-up" by Dr. Heuser

For Further Information Contact:

Ms. Laura Bates
NOWCASTING, INC.
101 Salem Street, Suite 4
Chico, CA 95926
(916) 895-5082

Ms. Janet Duerr
Center For Regional and Continuing Education
California State University, Chico
Chico, CA 95929-0250
(916) 895-6105

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Call (916) 891-1219 for reservations. $18 per person, one-way.

Departure from Sacramento

6:30 a.m
10:00 a.m. except Saturday
1:30 p.m.
4:00 p.m.
6:30 p.m. except Saturday
9:00 p.m.

Departure from Chico

4:00 a.m.
6:00 a.m. except Saturday
9:30 a.m.
11:30 a.m.
1:30 p.m. except Saturday
4:30 p.m.

WESTAIR SCHEDULE ENCLOSED

A WORKSHOP

WEATHER INFORMATION PACKAGES FOR USE IN ON-FARM OPERATIONS

"Farmers-Doing Something About The Weather"

MAY 22-23, 1984
(optional on-farm tour available May 21)

To Be Held At

CRAIG HALL CONFERENCE CENTER
1400 West 3rd Street
Chico, CA 95926
(916) 345-1393

Registration Fee
(See enclosed for full listing)
Please Pre-Register by April 30, 1984

	Pre-Register	At-the-door
*Students:	$20.00	$25.00
Invited Participants:	No fee	No fee
Others:	$40.00	$50.00

Workshop Administration

Coordinator	Dr. Rolland K. Heuser
Administration	Ms. Janet Duerr
Organizational Supervision	Ms. Laura Bates
Dean for Regional and Continuing Education	Dr. Ralph Meuter
Dean of Agriculture	Dr. Lucas Calpouzos
Dean of Communications	Dr. Henry Ingle

(*Academic credit available for an additional fee)

WEATHER INFORMATION PACKAGES WORKSHOP
REGISTRATION FORM

(Please pre-register by April 30, 1984)

Please make check payable to 'C.S.U., Chico' and mail with this form to:

Weather Information Packages Workshop
Center for Regional and Continuing Education
California State University, Chico
Chico, CA 95929-0250

Please check the appropriate accommodations. Type of room: cost per night, per person, including three meals.

___Single with two sharing a bath	$28.50
___Single with private bath	$34.50
___Double with private bath	$44.50
___Barbecue at University Farm	$10.00

Name______________________________________

Title______________________________________

Agency____________________________________

Address___________________________________

____

Phone (_____)______________________________

Date of Arrival:________Time of Arrival:________

*Airport of Arrival:___________________________

Date of Departure:____________________________

Check-in time:_________Check-out time:__________

(*Transportation will be provided from Chico Airport to Craig Hall Conference Center. Those arriving at Sacramento Airport, 90 miles south of Chico, may wish to contact 'Airport Transportation Service' for shuttle bus service. The shuttle schedule is listed in this brochure.)

MONDAY, MAY 21, 1984

1:00 p.m. Room Check-in begins.
3:30 p.m. Farm tour departs Craig Hall.
6:00 p.m. University Farm--Remarks by:
Dr. Lucas Calpouzos, Dean
School of Agriculture and Home Economics
NO HOST BARBECUE
7:30 p.m. NOWCASTING offices for California Wine Tasting

TUESDAY, MAY 22, 1984

7:15 a.m. BREAKFAST: Craig Hall Conference Center
8:15 a.m. Welcome by: Dr. John Morgan, Director of Research, CSU, Chico
8:30 a.m. Workshop format: Dr. Rolland K. Hauser
8:45 a.m. Presentation: Dr. Jon F. Bartholic, Michigan Crop-Pest Reporting System
9:05 a.m. Presentation: Dr. Norman L. Canfield, University of Maryland
9:25 a.m. Dr. William A. Dugas, Blackland Research Center, Texas
9:45 a.m. Discussion among Participants
10:15 a.m. COFFEE BREAK
10:30 a.m. Presentation: Dr. Amos Eddy, Oklahoma Climatological Survey
10:50 a.m. Presentation: ~~Dr. John Gerber,~~ David Hartsell Florida Agricultural Services and Technology
11:10 a.m. Presentation: Dr. Rolland K. Hauser NOWCASTING, Inc.
11:30 a.m. Discussion among Participants
12:00 noon Comments from the Floor
12:15 p.m. LUNCH
1:15 p.m. Comments: Dr. Hauser
1:20 p.m. Presentation: Dr. Howard L. Hill National Climate Program Office, NOAA
1:40 p.m. Presentation: Dr. Frances Holt, National Earth Satellite Data Information Services, NOAA
2:00 p.m. Presentation: Dr. Dale E. Linvill, Ag Extension, Clemson University
2:20 p.m. Discussion among Participants
2:35 p.m. COFFEE BREAK
3:00 p.m. Presentation: ~~Dr. V. Philip Rasmussen,~~ Utah State University
3:20 p.m. Presentation: ~~Dr. Gene Rauch, NWS, Stoneville, Mississippi~~
3:40 p.m. Presentation: Mr. Graham Rose, GRASSROOTS (Canada)
4:00 p.m. Discussion among Participants
4:30 p.m. Comments from the Floor
6:00 p.m. NO-HOST SOCIAL HOUR
7:00 p.m. BANQUET (included in registration fee)

Featured Speakers:

Mr. Robert D. Hennigan,
California Orchardist

Dr. Charles M. Smallwood, Dean,
Chairman of Ag Weather Task Force
State Board of Food and Agriculture

WEDNESDAY, MAY 23, 1984

7:15 a.m. BREAKFAST: Craig Hall Conference Center
8:15 a.m. Comments: Dr. Hauser
8:25 a.m. Presentation: Dr. Richard L. Snyder, California Irrigation Management and Information System
8:45 a.m. Presentation: Mr. Ron Stephens, NWS, Fresno
9:05 a.m. Presentation: Dr. Norton D. Strommen, World Food Outlook Board, USDA
9:25 a.m. Discussion among Participants
9:55 a.m. COFFEE BREAK
10:10 a.m. Presentation: Dr. S. Elwynn Taylor, Iowa Crop Advisory Network
10:30 a.m. Presentation: ~~Mr. Richard Henning,~~ AgriData Resources, Inc. Nancy Gardner
10:50 a.m. Presentation: Dr. Al Weiss, Ag Extension, University of Nebraska

Dr. HAUSER. Let me now comment briefly on the four points for examination at this hearing. First, the reliability, coordination, and efficiency of the existing Federal agricultural weather operations.

The existing operations maintain a high degree of professional reliability. Within the limits of the resources and technology available to them, it is our opinion that there is little distinction to be made concerning the degree of professional reliability that is produced among competent meteorological organizations, whether these organizations are public or private.

It is our opinion that Federal agricultural weather operations need to be better coordinated. First, there was a noticeable lack of involvement on the part of the existing Federal agricultural weather operations at the recent Federal Conference on Interactive Meteorological Processing that was held at the Goddard Space Flight Center at Greenbelt, MD, on November 1-3, 1983.

Second, there is an apparent thrust on the part of the hydrological programs of the National Weather Service that appears to need better coordination. Specifically, there is an effort to extend so-called alert weather system network technologies to apply to agricultural problems in a manner that has the potential to produce confusion among the farmers and foresters who are the ultimate users of such technologies.

The efficiency of existing Federal agricultural weather operations at the field and production levels is remarkable, in our opinion. The highly skilled and dedicated people who produce the products of these operations accomplish miracles with the resources at their disposal. They have our compliments on their performance.

We believe that the efficiency of any Federal activity, however, declines as the focus of operations narrows to smaller levels of concern. From the basis of our experience, we believe that a practical lower bound for efficient Federal agricultural weather operations will inevitably arise at the scale of regions about the size of three California counties or so.

The local-scale operations such as site-specific services or user-specific products provided to identifiable production organizations or to individual farmers lie beyond the domain of efficient Federal activity, in our opinion.

We believe that the most efficient sphere of Federal activity in these matters concerns the preparation and delivery of, and ease of access to, the massive, wholesale flow of raw weather data which is the product of the international weather system.

We do not believe that the Federal level is particularly efficient at either delivering retail information to end users by whatever the means or at processing raw data into decision information that is valuable at the local level.

Finally, we suggest that the existing complex of both public and private meteorological organizations clearly reveals four tasks which are more efficiently performed in the private sector than in the public sector. First is sorting and sifting the wholesale raw data flow; second, the taking of special observations for specific uses; third, the special processing of these observations to produce local-level decision information; and, finally, the special delivery mechanisms that provide this information directly to end users. We believe that existing Federal agricultural weather services are most efficient when they support these functions of the private sector.

These private-sector functions cannot be performed well without a strong, stable, and appropriate level of Federal agricultural weather observation. Such a level of Federal operation should be mandated.

Any such Federal mandate should be strictly limited so as to enable the private sector to build with strength and integrity as they complement and support such a national agricultural weather system. As a useful model of this kind of Federal activity, we suggest the operations of the Agricultural Extension Service.

We refer here to two key aspects of the Extension Service model. First, Extension is funded by a variety of levels of government; second, Extension operates in such a manner that once the education and demonstration functions of Extension are completed and growers have adopted the new practices, then routine services are provided by the private sector.

In this connection, we note that the Extension model should be expanded to take better advantage of the significant agricultural education activities now occurring in organizations which cooperate with and complement the traditional land-grant universities but which exist outside the confines of that historically limited group of institutions.

The second point for examination, the Agricultural Research Institute's proposed agricultural weather system plan. Nowcasting, Inc., has been aware of and has tracked the ARI plan during its development. We have made input into the plan, and it has been modified in response to issues we have raised. In particular, we note that the plan considers State level, regional levels operating at the sub-State domain, and local-level accommodation to the ARI plan as matters to be addressed at these respective levels. We think that is a good idea. The plan also emphasizes the need for public-private partnership.

We support the ARI plan with enthusiasm. We believe the plan will improve access to the wholesale flow of raw weather and climate data. We believe the plan improves the likelihood of fruitful partnerships between the public and private sectors.

The only danger we see is that some agricultural end users may—erroneously, in our view—infer that the ARI plan holds out the wavering straw that, properly, private sector agricultural weather and climate functions will be performed for them as free services provided by the Federal sector.

Such an unfortunate inference would act needlessly to delay the necessary market education and investment programs which in turn inevitably would delay the benefits of affordable, detailed local weather support for American agriculture.

The third point is the ability of the private sector to complement and support a national agricultural weather system. There is no question, in our view, of the ability of private meteorology to complement and support a national agricultural weather system. As this is true now for the Nation's commerce in such areas as aviation, transportation, construction, media, shipping, and offshore drilling, so can it be true in the area of agriculture. However, such private activity must have a stable base of Federal support on which to build. We appeal to you here today to act to provide this base.

In the supporting materials to my testimony are provided the names and addresses of several private firms, both forprofit and nonprofit. These firms stand ready, we believe, in an appropriate setting, to apply their energy, inventiveness, and modern technologies to America's agricultural weather problems.

[Material referred to above follows:]

List of Major Private Meteorological Firms with Known Ag-Weather Interest

(from Bulletin of the American Meteorological Society)

Gulf Coast Weather Service, Tampa, Florida
Control Data Corporation, Minneapolis, Minnesota
Accu-Weather, Inc., State College, Pennsylvania
Central Weather Service, Wheeling, Illinois
Global Weather Services Division, Commodity News Services, Inc., Leawood, Kansas
Nash C. Roberts, Jr., Consultants, Inc., New Orleans, Louisiana
Weatherbank, Inc., Salt Lake City, Utah
The MEP Company, Inc., Toronto, Canada
Florida Weather Service, Inc., Jacksonville, Florida
Intercon Weather Consultants, Inc., Suitland, Maryland
Environmental Satellity Data, Inc., Camp Springs, Maryland
Florida Agricultural Services and Technology, Gainesville, Florida
WSI Corporation, Bedford, Massachusetts
Independent Weather Services (of Australia) Pty., Ltd., Frenchs Forest, N.S.W.
Aeromatrix, Inc., Ann Arbor, Michigan
Global Weather Dynamics, Inc., Monterey, California
Freese-Notis Weather, Inc., Des Moines, Iowa
Weatherscan International, Oklahoma City, Oklahoma
IntraWest Weather, Bend, Oregon
NOWCASTING, Inc., Chico, California
AgriMarine Weather Services, Santa Barbara, California
Western Weather Inc., Sacramento, California
Climate Assessment Technology, Houston, Texas
AgriData Resources, Inc., Milwaukee, Wisconsin
Grassroots California, Bakersfield, California

TEST MARKET PIECE

Since you can't control Mother Nature, Cal Ag Weather and AgriData Network offer the next best alternative!

Site-Specific Reports can help you reduce irrigation and chemical application costs, and make pest management and weed control easier.

We'll install and maintain a weather station on or near your property. Through AgriData Network, agriculture's leading information and computing electronic service, you can access site-specific information precisely when you need it!

Irrigation Management

Evapo-transpiration (ET) rates — both observations and forecasts — provided by Cal Ag Weather Site-Specific reports can help you budget water usage and still maintain optimum yields. Based on an estimate provided by Pacific Gas & Electric Company, you can save between $10,000 and $15,000 per year in electricity expenses alone! And this estimate DOES NOT include the $4.00 per acre PG&E Special Energy Rebate Program. Save water. Save energy. Improve labor productivity. Increase your profits!

Pest Management

Obtain pest management information for your location from AgriData Network and Cal Ag Weather. No need to calculate growing degree days — it's done for you. Plus, five-day forecasts allow you to plan ahead. Save time and take the guess-work out of pest management.

Disease Control

Time sulphur applications systematically based on daily high and low temperature records and forecasts. Systematic timing methods can yield savings when compared to using a regular 7- to 14-day schedule. Control of other diseases such as brown rot, blossom blight and walnut blight can benefit by access to detailed local weather information.

Weed Control

Frequently updated local weather forecasts help you to avoid costly run-off due to rain. And pre-emergence aides may be applied precisely in time for Mother Nature to activate them, instead of relying on your irrigation system. Weather forecasts can even be tailored to double cropping patterns and can help you control effectively tough problems such as water grass in rice.

Aerial Applications

Time your aerial applications precisely by using the local wind speed and direction data available from Cal Ag Weather and AgriData Network! This information is updated every hour! You'll know what conditions are on your property before and during aerial applications.

AgriData Network selectively delivers more than weather:

Futures Prices — From all the major exchanges in the world.

Cash Market Prices — Obtain crop, livestock, and produce prices from markets in your area.

Market Analysis and Recommendations — Available on key commodities from not one but several accurate and respected services: Doane's, Helming, Top Farmer, Merrill Lynch and others.

Complete News Coverage — Agricultural, general and financial news available when you need it.

Government Reports and Legislation — Retrieve government reports seconds after they're released. Or follow legislation impacting on your business from the time it's introduced, until it's signed into law.

Complete Agricultural Weather In addition to the Site-Specific Reports provided by Cal Ag Weather, you may access weather by county, state, country or crop belt!

Electronic Mail Use StarGram to communicate electronically with other producers. Electronic mail arrives in seconds, not days!

Complete, current, site-specific weather management information is your key to survival

You have three options to choose from:

1. Buy your own conventional weather station.
2. Buy a stand-alone automatic weather station and micro-computer.
3. Subscribe to AgriData Network and design your own site-specific weather decision information package with Cal Ag Weather.

Compare these options:

	Capital Cost	Annual operating Maintenance Cost	Convenience	Reliability	Other Weather Services Included	Processed Information or Raw Data	World-wide Ag Info?	New Ideas Provided
OPTION #1 Conventional Weather Station	$350	$500	Poor	Fair	None	Raw Data only	No	No
OPTION #2 Automatic Weather Station & Micro-computer	$10 000	$800	Fair	Good	No	Both, if you pay for long-term software support	No	No
OPTION #3 AgriData Network & Cal Ag Weather	$600 (Data terminal)	$800	Excellent	Excellent (Calibrated every 30 mins)	Yes *	Both, no software required	Yes	Yes

* Global Weather Service, WSI Corp., Freese-Notis, National Weather Service - more to be added soon!

SPECIAL INTRODUCTORY OFFER FOR OPTION #3

For a limited time only, you can receive the following:

1. One year subscription to AgriData Network
2. Zenith ZTX-11 Data Terminal with built-in 300 baud modem.
   (or free software for your existing Apple, IBM-PC or other micro-computer.)
3. Site-specific weather reports from Cal Ag Weather.

FOR ONLY $1,199.00!

Dr. HAUSER. To further support this point, the very first meeting of the American Meteorological Society to devote an entire session to private-sector meteorology occurred this spring. In our opinion, it is unlikely that this clock of events in our profession will be turned backward.

Some firms are very active in the field of agricultural weather today. We are one such firm. I would be happy, in response to questions, to illustrate how our current activities support and complement the existing Federal operations. I would also be happy to answer questions about our clients and the fees that they pay.

Finally, I will address the Government, private sector, academic and user requirements and advice for a national agricultural weather system. Our advice is simple: We respectfully urge that you act now to stabilize an appropriate Federal agricultural weather operation and to improve access to the pipeline of wholesale raw weather information from the Federal Government which now, unfortunately, we believe, spews out of the pipeline, on the floor, and too much of it is wasted.

We urge that you act to define any Federal agricultural weather mandate, to perform those functions which have been chosen appropriately so as to ensure vigorous and competent private sector performance.

We urge you to promote private-public partnerships to accomplish the necessary work in a complementary and mutually supportive fashion.

Finally, we urge you to act to educate the users of Federal agricultural weather information to its actual costs and the benefits, and to educate them to the appropriate nature of both Federal and private responsibilities in agricultural weather.

Thank you very much, Mr. Chairman. I would be happy to answer any questions.

[The prepared statement of Dr. Hauser follows:]

TESTIMONY PREPARED

for

JOINT OVERSIGHT HEARING on a NATIONAL AGRICULTURE WEATHER OPERATION

House Agriculture Committee's Subcommittee on
Department Operations, Research and Foreign Agriculture

and

House Science and Technology Committee's Subcommittee on
Natural Resources, Agriculture Research and Environment

June 27 and 28, 1984

Dr. Rolland K. Hauser
Technical Director

NOWCASTING, Inc.
101 Salem Street, Suite 4
Chico, California 95926
(916)895-5082

June 21, 1984

It is an honor and a privilege to be invited to appear before you today. I will begin with a brief description of the organization for which I serve as Technical Director.

NOWCASTING, Inc. and its operational arm, called Cal Ag Weather, have grown from work which began in January 1979. A group of northern California agricultural interests, mainly orchardists, decided that Federal budgets for ag weather services were very unlikely to increase. It was felt an increase by a factor of three to ten times would be necessary if the Federal government were to provide the degree of "free" ag weather and climate support needed for survival during the economic, social and political climate of the 1980s and 90s. Self-help at the grass-roots level was needed.

Our work began as a research and development project under the auspices of The University Foundation of California State University, Chico. On July 1, 1981 a new not-for-profit corporation was formed under Public Law 501(c)3 to perform educational and scientific functions related to this topic. In early 1982 a subsidiary, Cal Ag Weather, was created to deliver "ag-weather" services on a routine basis. NOWCASTING's Board of Directors, who are prominent California agribusinessmen, chose an organizational framework which was modeled after the California Farm Bureau Federation which, itself, is a not-for-profit organization. The author presents this testimony as a representative of these California growers.

Our goal is to provide services year-round, and in a very site-specific and commodity-specific manner. We intend to supply complete, one-stop ag weather service wherever our services are desired. It is not our goal to replace or threaten in any way the extremely valuable, but more generalized, ag weather services provided by the National Weather Service. In fact, our "perfect world" would be one of intimate interaction between Cal Ag Weather employees and both NWS and Cooperative Extension Service field personnel at the local level. We know that California agriculture would benefit from this kind of public-private partnership. We believe these benefits would apply throughout the nation.

I have delivered written copies of my remarks and some supporting materials to Mr. Jack Fellows of the Office of the Honorable George E. Brown, Jr. It is my intent that these materials be included in the written record of the hearing and that they serve as additional background for any questions you may have. The four most important items included in the supporting materials are listed on the last page of this document.

I will comment briefly on the four points for examination at this hearing.

1. The reliability, coordination and efficiency of the existing federal agricultural weather operations.

   The federal agricultural weather operations maintain a high degree of professional reliability. Within the limits of the resources and technology available to them, it is our opinion that there is little distinction to be made between the degree of professional reliability that is produced among competent meteorological organizations, be they public or private.

   It is our opinion that federal agricultural weather operations need to be better coordinated. Specifically, there was a noticeable lack of involvement on the part of federal agricultural weather operations at the Federal Conference on Interactive Meteorological Processing that was held at the Goddard Space Flight Center at Greenbelt, Maryland on November 1-3, 1983. Secondly, there is an apparent thrust on the part of the hydrological programs of the National Weather Service to extend Alert weather-system technologies to agricultural problems in a manner that has the potential to produce confusion among the farmers and foresters who are the ultimate users of such technologies.

   The efficiency of the existing federal agricultural weather operations at the field and production levels is remarkable. The highly-skilled and dedicated people who produce the products of these operations accomplish miracles with the resources at their disposal. They have our compliments on their performance.

   We believe that the efficiency of any federal activity declines as the focus of operations narrows to smaller levels of concern. From a basis of our experience, we believe that a practical lower bound for efficient federal agricultural weather operations will inevitably arise at the scale of "regions" about the size of "three California counties" or so. Such "local-scale" operations as site-specific services or user-specific products provided to identifiable production organizations or to individual farmers lie beyond the domain of efficient federal activity, in our opinion.

   We believe that the most efficient sphere of federal activity in these matters concerns the preparation and delivery of and access to the massive, wholesale flow of raw weather data which is the product of the international weather system. We do not believe that the federal level is particularly efficient at either:

-- delivering retail information to end users, by whatever the means; or

-- processing raw data into decision information that is valuable at the local level.

Finally, we suggest that the existing complex of public and private meteorological organizations reveals four tasks which are more efficiently performed in the private sector than in the public sector:

-- sorting and sifting the wholesale raw data flow;

-- special observations taken for specific uses;

-- special processing to produce decision information;;

-- special delivery direct to end users

We believe that existing agricultural weather services are most efficient when they support these functions of the private sector. These functions of the private sector cannot be performed well without a strong, stable and appropriate level of federal agricultural weather operation.

Such a level of federal operation should be mandated. Any such federal mandate, however, should be strictly limited to enable the private sector to build with strength and integrity as they complement and support such a national agriculture weather system.

As a useful model of this kind of federal activity, we suggest the operations of the Agricultural Extension Service. In this connection, we note that such a model should be expanded to take better advantage of the significant agricultural education activities now occurring in organizations which cooperate with and complement the traditional Land-Grant Universities, but which exist outside the confines of that historically limited group of institutions.

2. The Agricultural Research Institute's proposed agricultural weather system plan.

NOWCASTING, Inc. has been aware of and has tracked the ARI plan during its development. We have made input into the plan, and it has been modified in response to issues we have raised. In particular we note that the plan considers state-level, sub-state regional-level and local-level accomodations to the ARI plan as matters to be addressed at these respective levels. The plan also emphasizes the need for public-private partnership.

We support the ARI plan with enthusiasm. We believe the plan will improve access to the wholesale flow of raw weather and climate data. We believe the plan improves the likelihood of fruitful partnerships between the public and private sectors.

The only danger we see is that some agricultural end users may, erroneously in our view, infer that the ARI plan holds out the wavering straw that private-sector agricultural weather and climate functions will be performed for them as free services provided by the federal sector. Such an unfortunate inference would act needlessly to delay the necessary market education and investment programs which, in turn, inevitably would delay the benefits of affordable, detailed, local weather support for American agriculture.

3. The ability of the private sector to complement and support a national agricultural weather system.

There is no question of the ability of private meteorology to complement and support a national agricultural weather system. As this is true for the nation's commerce in such areas as aviation, transportation, construction, media, shipping, and off-shore drilling, so can it be true in the area of agriculture. However, such private activity must have a stable base of federal support on which to build. We appeal to you here today to act to provide this base.

In the supporting materials to my testimony are provided the names and addresses of several private firms, both for-profit and not-for-profit. These firms stand ready we believe, in an appropriate setting, to apply their energy, inventiveness and modern technologies to agricultural weather problems. To further support this point, the first meeting of the American Meteorological Society to devote an entire session to private-sector meteorology occurred this spring.

Some firms are very active in the field of agricultural weather today. We are one such firm. I would be happy, in response to questions, to illustrate how our current activities support and complement the existing federal operations. I would be happy, also, to answer questions about our clients or to show examples of our products.

4. The government, private sector, academic and user requirements and advice for a national agricultural weather system.

Our advice is simple:

-- act now to stabilize an appropriate federal agricultural weather operation;

-- define any federal agricultural weather mandate to perform those functions chosen appropriately so as to ensure vigorous and competent private-sector performance;

-- promote private-public partnerships to accomplish the necessary work in a complementary and mutually supportive fashion;

-- educate the users of agricultural weather information to the actual costs and benefits, and to the appropriate nature, of federal and private responsibilities in agricultural weather.

ADDITIONAL BACKGROUND DOCUMENTS

-- The program for the Special Workshop on Weather Information Packages for Use in On-Farm Operations, held at Chico, California on May 22-23, 1984 and co-sponsored by the W.K. Kellogg Foundation, the California Department of Food and Agriculture and California State University, Chico;

-- Remarks addressed to that Special Workshop held May 22, 1984 in a speech by Mr. Robert D. Hennigan, Jr. who is a prominent California grower and farm manager;

-- A summary of a presentation entitled Real-Time Mitigation of Agricultural Hazards Associated with Minor Hydrologic Events, presented at the Technical Conference on Mitigation of Natural Hazards through Real-Time Data Collection Systems and Hydrological Forecasting, held at Sacramento. California on September 19-23, 1983.

-- A paper entitled The NOWCASTING, Inc. Approach for Providing Ag Weather Services in California, presented at the Conference on Cooperative Climate Services sponsored by the National Program Office, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, held March 22-24, 1983, at Tallahassee, Florida.

Mr. Brown. Thank you, Dr. Hauser.

Mr. Skoloda, please go ahead with your testimony.

STATEMENT OF DAVID M. SKOLODA, VICE PRESIDENT FOR INFORMATION SERVICES, AGRIDATA RESOURCES, INC.

Mr. Skoloda. Thank you.

Mr. Chairman and members of the committee, my name is David Skoloda and I am vice president of information services of AgriData Resources in Milwaukee, WI.

I would like to thank you for the opportunity to provide the committee with information about the private sector's role in providing weather information to agriculture.

AgriData is a publishing company dedicated to meeting farmers' needs in the information age, and weather information is certainly a major part of those needs, a fact amply documented in the testimony here this morning. Of course, this growing season has provided more than ample evidence of that.

AgriData is an established publisher of printed materials aimed at assisting farmers in the management of a modern agricultural business. Among the publications is Farm Futures magazine, the readership of which includes 200,000 farmers; and Top Farmer Intelligence, a market advisory newsletter. But it is AgriData's AgriData network that plays the private sector role in weather information dissemination that I want to describe for you today.

Agridata, or ADN for short, is an online information and communication service for the agricultural community. ADN is essentially an information shopping mall, if you will, with many information companies and public institutions, about 35 at last count, who together draw on hundreds of sources around the world, making their products available to end users through the network.

The ADN user community consists of farmers, ranchers, brokers, suppliers, bankers, agribusiness, education, and government. The sources cover the complete range of information likely to be of value to the agricultural community, and thousands of reports are available at any given time.

For example, market information from a variety of sources provides farmers and ranchers with information essential to their use of the futures and cash markets as a risk management tool or in making the decision as to when to bring their products to market. When options trading begins this fall, the information generated by that activity will add greatly to the volume of information available to farmers.

Local short-term weather information is available for regions across the United States to provide farmers with assistance in planning the planting and care of their crops; foreign weather conditions are reported to help determine the condition of foreign crops. This in turn helps farmers assess the prospects for sales of their products overseas.

A good example of this, of course, is the careful attention being given to the progress of the Soviet crops due to the dry weather there this spring. Many reports, including news stories that address agricultural issues around the world, are updated throughout the day, while other regularly updated reports change as frequently as every minute.

ADN, then, provides information that has a high value to agriculture because of its perishability or timeliness or because of the difficulty of obtaining specific information in any other way except by using the combined power of computing and telecommunications.

Weather fits well into that category. However, so does marketing information, and it may not surprise you that marketing news—prices, fundamental and technical analysis and recommendations—are the highest accessed reports in the ADN system.

We believe, however, that before long weather reports—both reports with data such as growing degree days and temperature and precipitation and so-called value added reports with analysis and recommendations—will be challenging the marketing reports for access leadership.

The reason is that the weather information will grow quickly as weather companies develop specialized agricultural weather reports that take advantage of the growing knowledge about the relationship of weather and biological systems. Also, companies increasingly are making available to farmers the analytical, "What does it mean?" reports on weather that previously have been available mainly to the major grain traders. The other reason is that weather, particularly this summer, is a key part of the market picture.

Thus, the economic incentive for obtaining market information applies as well to obtaining weather information, since the two are so closely linked. In addition, of course, agricultural weather information helps farmers using rainfall, temperature, and other forecast information to make management decisions that reduce weather-related crop damage, schedule water, pesticide, fertilizer applications, and make other cost-saving judgments about crop production.

I have included attached to the prepared copies of this testimony a sample of the types of weather reports now available online in ADN. More weather information is to be added in the future. Agri-Data and Nowcasting, for example, are now jointly developing a highly specialized weather product for California agriculture. This product is being prepared specifically for distribution electronically.

In brief, then, what I have described is a model our company believes will serve agriculture well with weather information. Many sources, using a mix of Government and privately obtained data, can easily and economically reach farmers with enhanced weather reports on a timely basis. The system is in place and it works.

As with any emerging technology, there are many changes ahead to provide the fullest range of information needed by farmers and those who serve them. The economic incentive exists to provide that information, however.

The challenge for all of us will be to provide the educational support with the information to help farmers make productive use of it. There is a strong incentive for us to do this as well.

We can demonstrate that information can make money for farmers. As more farmers recognize that, they will also realize that information costs are another cost of doing business, and not a very big one at that, considering the potential returns on the investment.

ADN's weather information providers include WSI Corp. of Bedford, MA; Global Weather Service, Kansas City; Freese-Notis Weather of Des Moines. I am sure that these companies would be happy to provide you with their views on this subject, and I would be happy to provide any additional information.

In summary, our company does not question the need at all for excellent weather information in agriculture or the need for a Federal role in that process. We are concerned that in structuring that program, a stable environment be created for the private investment in development and dissemination of that information.

Thank you very much for your time.

[The prepared statement of Mr. Skoloda follows:]

On-line Weather Information for Agriculture

Remarks prepared for the Joint Oversight Hearing on a National Agriculture Weather Operation

by David M. Skoloda
Vice president/information services
AgriData Resources, Inc.
Milwaukee, WI 53203

Thank you for the opportunity to provide the committee with information about the private sector's role in providing weather information to agriculture. AgriData Resources is a publishing company dedicated to meeting farmers' needs in the information age. And weather information is a major part of those needs. This growing season has provided ample evidence of that.

AgriData is an established publisher of printed materials aimed at assisting farmers in the management of a modern agricultural business. Among the publications is FarmFutures magazine, the readership of which includes 200,000 of the nation's largest farmers, and Top Farmer Intelligence, a market advisory.

newsletter. But it is AgriData's AgriData Network that plays the private sector role in weather information dissemintation that I want to describe for you today.

AgriData Network, or ADN for short, is an on-line information and communication service for the agricultural community. ADN is, essentially, an information shopping mall, with many information companies and public institutions (about 35 at last count who together draw on hundreds of sources around the world) making their products available to end users through the network. The ADN user community consists of farmers, ranchers, brokers, suppliers, bankers, agribusiness, education and government. The sources cover the complete range of information likely to be of value to the agricultural community and thousands of reports are available at any given time. For example, market information from a variety of sources provides farmers and ranchers with information essential to their use of the futures and cash markets as a risk management tool or in making the decision as to when to bring their products to market. When options trading begins this fall, the information generated by that activity will add greatly to the volume of information available to farmers. Local short-term weather information is available for regions across the U.S. to provide farmers with assistance in planning the planting and care of their crops; foreign weather conditions are reported to help determine the condition of foreign crops. This, in turn, helps farmers assess the prospects for sales of their products overseas. A good example of this is the careful attention being given to the progress of the Soviet crops due to the dry weather there this spring. Many reports, including news stories that address agricultual issues around the world, are updated throughout the day, while other regularly updated reports change as frequently as every minute.

AgriData initiated its U.S. service in late 1982 as the AgriStar system and changed its name to AgriData Network in 1983. This new name was selected to reflect both the diversity of information available on the system and the independence of the service from any particular source of information using the network as a vehicle to disseminate information.

ADN, then, provides information that has a high value to agriculture because of its perishability or timeliness or because of the difficulty of obtaining specific information in any other way except by using the combined power of computing and telecommunications.

Weather fits well into that category. However, so does marketing information and it may not surprise you that marketing news-- prices, fundamental and technical analysis and recommendations--are the highest accessed reports in the ADN system. We believe, however, that before long weather reports--both reports with data such as growing degree days and temperature and precipitation and so called value added reports with analysis and recommendations-- will be challenging the marketing reports for access leadership. The reason is that the weather information will grow quickly as weather companies develop specialized agricultural weather reports that take advantage of the growing knowledge about the relationship of weather and biological systems. Also, companies increasingly are making available to farmers the analytical, "what does it mean" reports on weather that previously have been available mainly to the major grain traders. The other reason is that weather, particularly this summer, is a key part of the market picture. Thus, the economic incentive for obtaining marketing information applies as well to obtaining weather information since the two are so closely linked. In addition, of course, agricultural weather information helps farmers using rainfall, temperature and other forecast information to make management decisions that reduce weather-related crop damage, schedule water, pesticide, fertilizer applications and make other cost-saving judgements about crop production.

I have included attached to the prepared copies of this testimony a sample of the types of weather reports now available on-line in ADN. More weather information is to be added in the future. AgriData and Nowcasting are now jointly developing a highly specialized weather product for California agriculture. This product is being prepared specifically for distribution electronically in ADN.

In brief, then, what I have described is a model our company believes will serve agriculture well with weather information. Many sources, using a mix of government and privately obtained data, can easily and economically reach farmers with enhanced weather reports on a timely basis. The system is in place and it works. As with any emerging technology, there are many changes ahead to provide the fullest range of information needed by farmers and those who serve them. The economic incentive exists to provide that information.

The challenge for all of us will be to provide the educational support with the information to help farmers make productive use of the information. There is a strong incentive for us to do this as well. We can demonstrate that information can make money for farmers. As more farmers recognize that, they will also realize that information costs are another cost of doing business, and not a very big one at that, considering the potentential returns on the investment.

ADN's weather information providers include WSI Corp. of Bedford, MA, Global Weather Service, Kansas City, Freese-Notis Weather, of Des Moines. I'm sure that these companies would be happy to provide you with their views on this subject. And I would be happy to provide additional information in the future and answer any questions.

Thank you.

Mr. OLIN [acting chairman]. Thank you, Mr. Skoloda.

Mr. Chairman, would you like to ask some questions?

Mr. BROWN. By a strange coincidence, I am going to have to leave in a couple of minutes to address a conference on large-scale computing needs in this country.

We have had a major focus in this subcommittee for some time as to how agriculture could be better integrated with the newly emerging technologies for the purpose of making agriculture more profitable. You just made reference to that, Mr. Skoloda, as to how information can make money for farmers.

Obviously, in the weather field, we need to integrate this with other forms of information systems, and what we need to do is to try to define a system which all of you have focused on here, which properly utilizes the role of the Federal Government in cooperation with the private sector, and that is a problem that is running across a number of areas at the present time. So we see this not only as something of significance to the farm community but as a kind of generic problem having to do with the role of the Federal Government, and particularly in some of these emerging technological areas.

So your testimony is very helpful in that regard. I might say that several years ago I authored the Climate Program Research Act, which is on the books in this country. I have been a little disappointed because that act was mandated to move ahead with research in some of these areas, not just meteorological research, but in the application of meteorological information for the needs of this country.

Like any new program, it has not fully lived up to the expectations that I had had of it. But your testimony is giving us some new inspiration, I think, to see if we cannot bring all these pieces back on track and conceptualize or define a system which will meet the current needs that we have and couple those needs with the current technological resources that we have. Am I being unrealistic in expecting that? I want to give you an opportunity to comment.

Dr. HAUSER. I am familiar with the act and the progress that you refer to. In fact, through the office of Howard Hill at the National Climate Program Office in NOAA, I had the opportunity to be a part of a symposium at the annual meeting 1 year ago at the American Association for the Advancement of Science on trying to look at climate programs through the eyes of users.

Let me say first of all that I don't think our organization would still be in existence if it weren't for the fact that farmers could come in and look over our shoulders and see that in fact the information they need to use to make money is there in the system. They know that.

But the challenge is to perform the transition of that information into their frame of reference. The approach that we have used is to put the farmers in charge. Our board of directors are farmers. The other part of our technique is to not reinvent a wheel that exists at the local level. Farmers are old hands at examining new technologies, and they are businessmen that make decisions all the time in the face of imperfect information. They have invented mechanisms that fit their own commodities, their own geography, and their own rural sociology.

I think the strength of the ARI plan is that in their coordination technique that they have here, they provide a forum for this kind of coordinated activity and input from the users to occur.

I am not familiar enough with how the climate program operates in practice to know if that is a part of that operation or not. I suspect that they are doing the best they can within the resources they have at their availability.

Mr. Brown. Well, they are really not doing enough on the user end of it. I have that criticism of the plan. But that was not the intention.

I, as a reasonably practical politician, know that any fundamental research program has to be supported by some concept of end users being able to utilize the results of that. Of course, your function, or your company's function, is to provide the management knowledge, the software, the other kinds of things that can integrate this into the farm operations. I presume that your board of directors, your clients, are farmers who are large enough to afford computer terminals or other ways of accessing this data, and that you can provide them with the software which can convert that to management information.

Dr. Hauser. I would estimate about 5 percent of our individual clients have their own personal communication device equipped for telecommunications. But they are all members of some organization, be it the Farm Bureau or the commodities organization, and that is highly computerized. I don't think there is one that does not have that kind of access.

They do prefer, in our view, to receive the information by telephone, voice recording, rather than by computer terminal, because they are not at home in front of the computer terminal.

Mr. Brown. But as they utilize that data for more sophisticated management decisions, for example, using soil moisture data to determine planting or spraying or harvesting or other kinds of decisions, won't they need computer programs to do that?

Dr. Hauser. Yes, but in general these are people who purchase advice of a technical nature. In California, our clients in general purchase irrigation advice; they purchase pest management advice; they purchase nutrition advice; they purchase disease control advice, soil advice. They are so busy they don't have time to be their own technical person.

The size of our growers ranges from 3-acre kiwigrowers to 2,500-acre ricegrowers.

Mr. Brown. Well, I am going to ask to be excused, and Mr. Olin will complete the questioning and excuse you as soon as he is completed.

Mr. Olin. Fine. Thank you, Mr. Chairman.

I was not able to hear much of the testimony, and I apologize for that, but I am interested in asking a couple of questions regarding the role of the Federal Government in a more comprehensive weather program as it relates to the private role which you are serving on the local level.

Could each of you perhaps comment on that as to how strong a role you think that the Federal Government ought to be playing in masterminding the system and interfacing with you all? Dr. Felch, could you start first?

Mr. **Felch**. Yes, I will go ahead and start.

From my perspective, I see the need for just a good basic information services activity from the Federal Government. This goes from the collection of the basic data to possibly some of the basic analysis of that; a coordination dissemination mechanism so that we have access to that information; and, too, as even they do today, giving some basic advisories to agriculture in general.

Of course, much of my experience is the Corn Belt part of the country, and it is a little different from Florida where they have 25 crops in 25 adjoining farms. But there is a broad-based audience out there that needs good farm information; they need the education process about how to effectively utilize that; and yet, from their perspective, they don't really understand that it might be worth a great deal of money.

I don't see a broad role in that from an agricultural weather information standpoint for the private sector in that area. I think, for the private sector, it is getting into the more specialized agriculture.

Mr. **Olin**. You are saying you do not see a broad role for the private sector? Did I hear that correctly?

Mr. **Felch**. I think I didn't really mean that in that sense.

Mr. **Olin**. Could you say that again, then?

Mr. **Felch**. OK. I think there would be a limited role for the private sector, because the value to the farmer, if you are providing strictly agricultural weather information services, is relatively small relative to his cost of production. He is working on a very narrow margin, as opposed to a more highly intensive agriculture where you have a tremendous investment and the response to critical information is more important and much more valuable from a dollar-and-cents standpoint. Now, the key to the value to the grower is when you start combining that basic weather information with market information, other things that are affecting—the international weather, things like that. So you start building more comprehensive information systems. I think Dave might want to comment. I don't want to put him on the spot, but he would have a hard time making money selling strictly weather information.

Mr. **Olin**. Mr. Skoloda.

Mr. **Skoloda**. Well, I would prefer to comment from the standpoint of what we would hope to be able to do from the private sector, and that is to provide the conduit for effective, useful weather information from whatever source. But I would defer to the private companies actually generating that information as far as what they need in the way of support from the Federal Government and to the growers, of course, as to how effective they are being in providing the information that they need. Ultimately, we want to provide information that is useful. Otherwise, we have no purpose for being. Whichever system is the most effective—and I think that Dr. Hauser, for example, has pointed out precisely what role he believes the Federal Government needs to play in that process.

We really see ourselves as a conduit and a utility in fact in providing information, and our primary purpose here today would be to indicate that such systems do exist and can be effective disseminators and, I might add, unless they are good hackers, keep our Mr. LaVine's cheapskates as well, we hope, anyway. [Laughter.]

Mr. **Olin**. Dr. Hauser, did you have anything to add on that?

Dr. **Hauser**. A key point is to improve the accessibility to this massive outflow of information, and I think the regionalized, multi-State center concept in the ARI plan has promise to do that, if properly implemented.

Mr. **Olin**. Yes.

Dr. **Hauser**. We see that the expense for Government of matching farm-specific, problem-specific information as a Government service in that level of detail becomes very expensive, very fast, for Government. So then you are faced with the problem of drawing a line somewhere, and we would urge the drawing of that line in such a way to promote active private participation, and to us that means inside State regions on the size of three or so California counties as a geographical delimiter.

Mr. **Olin**. You are talking regions. Are you thinking something like—what kind of number? Nine or ten regions in the Nation?

Dr. **Hauser**. Well, there are two uses of the word, and I have used it twice, once in each concept. The multi-State, several-State regional center we think is a useful Federal Government and cooperative State concept because it opens up access to the pipeline of information.

Then there are existing agricultural weather operations in the Federal sector which are very valued by farmers to perform valuable services within the limits of their resources.

On the regional idea which is a piece of a State, two or three counties, I am speaking more of the perception in the farmer-end user's mind of the purpose of that work. Farmers, it is our opinion, are willing to pay for services that apply to their farm and their problem, where they can evaluate the money they make associated with that. They will spend a dollar if they can make $1.10 or $1.15 and they are certain of that.

So I think that practical limits of Government expense mean that there has to be some smaller bound, and I suggest that second inside-the-State regional concept as something that needs to be examined.

Mr. **Olin**. I appreciate that comment. I think I would generally tend to agree with you that that local service is one that the Federal Government is not likely to do too well. It is not likely to be flexible enough and also couple other services with the weather service in order to get something that the farmer is willing to pay for, whereas a private person located locally can do that much more efficiently and without the bureaucratic problems that might arise otherwise.

Dr. **Hauser**. Let me just emphasize one final point, and that is, we see our role as complementary and supportive of this minimum level of Federal Agricultural Weather Service.

I raise this point because, in our market education activities, we have had farmers tell us point blank if ideas such as ours or other private sector ideas that are abroad in the Nation succeed, somehow, in a bureaucratic world that I don't profess to understand, that the action would be, then, that the Federal Government would reduce or remove this valued base line of Federal service.

We do not advocate that, and, frankly, we see that kind of activity as bizarre, and we would oppose it.

Mr. OLIN. Mr. Roberts has joined us.

Mr. Roberts, your opening statement has been included in the record. Do you have anything you would like to add at this point? We have heard all of our witnesses, and we are right about at the end of the session.

Mr. ROBERTS. It seems like an appropriate time to come in, Mr. Chairman.

Mr. OLIN. It is fine.

Mr. ROBERTS. It is indeed unfortunate that a Member of Congress' schedule is like the weather, and that is unpredictable, and I apologize for my late arrival.

I want to thank you for including my full statement in the record and showing my keen interest in this entire hearing.

Mr. OLIN. Does the panel have anything else they would like to add?

Mr. DE LA GARZA. Mr. Chairman?

Mr. OLIN. Oh, excuse me, Mr. Chairman.

The CHAIRMAN. May I have a minute?

Mr. OLIN. The chairman of the full committee, yes.

The CHAIRMAN. Let me apologize to the panel and to the other witnesses. My problem is having to be three places at the same time. My absence during the morning has been through no lack of interest or appreciation for your contribution.

I am sorry that I may be repeating questions that might have been asked, but, Dr. Hauser, I read your testimony prior to attending the session this morning, and it was very interesting. Basically, your testimony fits into my thoughts. But I wanted to get a little bit more—if you have already done it, then I will check the record—but how your operation works, the economic factor of your endeavor. Can it or could it operate economically if you did not have the raw data supplied from the Federal resources?

Dr. HAUSER. I will take the last part first. The massive outflow of raw weather data from the International Weather Service system is essential to any private meteorological organization. I need here to address a certain scale of activity.

The long-term baseline weather stations which are operated by the Federal Government, the data collection system operated by the Federal Government from these stations, the large computer programs that analyze and forecast from these data, supplying them—the maintenance of this data in a climate archive and access to that climate archive, the operation and distribution of weather satellite information—these are all functions that we feel properly reside in the Federal sector.

To help you visualize this, we see the end result of this as a big oil pipeline of information. The problem we see is that right now most of that national resource coming out of the pipeline is now falling on the floor and running away.

The CHAIRMAN. I got that part of your testimony, that you feel we should coordinate better.

Dr. HAUSER. So I think that is the place where the energies and initiatives of the private sector and farmers themselves and State agencies and the Extension Service and USDA need to coordinate and cooperate, and I think that is the strength of the ARI plan.

Now, in addition, for local data on individual farmers' farms, we operate weather stations there, and we use that in order to make forecasts that are very precise for precise problems on those farms, and there are some farmers who don't want that particular data shared with anyone. In a prime Chardonney grape-growing region, they are not particularly interested in having anyone find out how that grape crop is coming along, so our mechanism simply flags that information, and we exchange some of the data quite openly and freely as a point of public service with the State Department of Water Resources, for instance, and others we do not because the farmers who have the problem do not want the data shared.

The CHAIRMAN. Well, then, do you do like what the Weather Service does? Do you have a spotter or a farmer who calls you periodically?

Dr. HAUSER. We have some of that. We maintain a little office recording machine and an 800 number, and farmers and farmers' secretaries and farmers' bookkeepers call us and tell us what is going on the farm.

We also operate computers located on poles and towers in fields and orchards that we dial on the telephone once an hour to see what very light winds are doing in conditions of spraying activity and field burning, so we can become very specific.

The CHAIRMAN. I don't know if the question is really a fair question or not, and you don't have to answer it if you don't feel like you can, but without the raw data—I guess what I am trying to grasp at is, could you operate as a viable economic entity if you had to do the whole thing yourself?

Dr. HAUSER. Of course not.

The CHAIRMAN. And no one, at least in that area or region could conceivably do it without the input of what we have now through Federal resources?

Dr. HAUSER. We support the maintenance of a vigorous and active baseline National Weather Services operation for agriculture.

The CHAIRMAN. Now, just from your company, besides just telling us that it is just coming out of the pipeline and flowing onto the floor, if we were going to do it only for your company, what would you ask the Federal Government to do, a company such as yours? I don't remember—you are not a foundation; you are a for-profit organization, aren't you?

Dr. HAUSER. We are a nonprofit organization.

The CHAIRMAN. A nonprofit, OK. A nonprofit or a for-profit of the level of your operation, what would you have the Federal Government do to better strengthen your ability to provide the service?

Dr. HAUSER. We would ask the Federal Government to operate a satellite radio broadcasting service that is nonencrypted on which the National Weather Services family of public services and the stretch VISSR output of the GOES weather satellites is available to inexpensive receivers, and let the garage-shop industries of the Nation take off.

The **Chairman**. Would you, if you had a satellite that you would have a private number to, if that were possible——

Dr. **Hauser**. No, I would let competition work.

The **Chairman**. Would you pay *x* amount for an ability to link onto the satellite?

Dr. **Hauser**. I would like to be treated in that regard the same way that foreign governments are. If they get it free, I would like it free.

The **Chairman**. Well, that is fair enough. [Laughter.]

Dr. **Hauser**. But, on the other hand, I think it is the responsibility of the Federal Government to make that available at as low cost as possible. I think it is possible to have bad things happen. I think the airmen's technical manuals are an illustration of how to have inappropriate things happen. A user's fee was accepted which was $3 or $4 for documents from the Department of Transportation that used to be available free, and you had to get these things to keep your license current. Then after a while the price went up to $5 or $6 and, of course, as the price went up, the demand went down, and pretty soon they were $70 or $80, and, lo and behold, a cottage industry grew up of people with Xerox machines, and the Federal Government was now producing all of this at a very high cost and not creating much revenue.

The **Chairman**. I found that out.

Dr. **Hauser**. I urge that the Government err in the other direction and make it available at the end of the pipeline.

The **Chairman**. I had my airmen's manual, the basic, and I gave it away to somebody. I had my office call that I wanted another one, and I found out I had to buy it now. [Laughter.]

Dr. **Hauser**. Did you buy it from the Government or one of the garage shops?

The **Chairman**. No, I bought it from the Government. I have to be loyal. [Laughter.]

Mr. Chairman, just one last question. I guess your testimony is the one that more fits what I would have said if I were the witness, and I appreciate it very much.

The one last question is that the availability of the raw data needs to be coordinated better, either for a for-profit or a foundation such as yours. Is there a capability for you to expand your operation to a larger region or maybe like to the State of California? Could that be done from one locality, or would you have, of necessity, to be physically some other place?

Dr. **Hauser**. If we were to advocate that from Chico, CA, to northern California, we would run into the not-invented-here syndrome, understandably so in the way that agriculture operates.

There is a model that has been proposed. It comes from the State of Oklahoma. I think it is worth your examination. I understand it has the support of Dr. Byrne, currently the chief administrator of NOAA. It is called the Oklahoma Weather Center or the Applied Sciences Institute. The unique thing about is that it is the first time that I am aware of that the Federal Government has said that it is okay for National Weather Services employees and for private sector employees to work side by side. We think that is a healthy step. We think it conserves resources. We think it coordinates things, and it is worth your examination. Our board of directors of farmers, if they were to undertake an expansion of the kind that you describe, would do it in a very businesslike manner. They would do it in response to a business plan. They would examine the economics of it, the costs, the benefits, the impact on clients and market, and our opinion is that there are still significant things that Dr. Felch has referred to, and I know that the Florida system of FAST is experiencing, regarding the education of the agricultural user community, the involvement of they, themselves, as organizations. This takes time. So we would approach that with caution, but we think there is benefit there.

The CHAIRMAN. I am glad you mentioned that, because the bureaucratic mind does not take into consideration the human element. They deal in a vacuum. In my area, if you don't hear it from Charlie Rankin, it ain't weather. [Laughter.]

And that is my problem. I have just been confronted with a situation where they going to automate aviation weather, and they are moving from my region to San Angelo, TX, which is some 600 miles away. It is going to be, I assume, through the computer and the 800 number, the same weather you could get there in McAllen, but all of the private aviation people and general aviation people that I know, including two very good pilots that fly me periodically, say that they are not going to believe it because at McAllen they go and look at the chart, and they are not going to ever believe some computer in San Angelo, 600 miles away.

But the bureaucratic mind doesn't take into consideration the human element, and if you have a farmer with doubt when he should burning in a freeze time, a doubt that is almost as vulnerable as if the astronauts had a doubt as to whether to make the correction or not, and costing hundreds of thousands of dollars.

So I appreciate very much your testimony and your being here, and I am sure that you know that your contribution is invaluable to us as we look at this whole aspect of ag weather. We thank you and all the witnesses.

Thank you, Mr. Chairman.

Mr. OLIN. As usual, the chairman of the full committee grasped the subject very fast, and he is getting the point.

This has been a very, very good hearing, and I think we all got the message that the Federal Government has a strong role to play. It needs to keep its operation simple but needs to work on the interface with the local people, where you can be very, very specific about what should happen on this farm and that farm, which the Federal Government could not possibly handle no matter what it did.

Mr. Roberts, did you have anything else?

Mr. ROBERTS. No.

Mr. OLIN. If there is nothing else from the panel or the committee, the hearing stands adjourned.

[Whereupon, at 11:47 a.m., the subcommittees recessed, to reconvene the following day, Thursday, June 28, 1984.]

AGRICULTURAL WEATHER SERVICES

THURSDAY, JUNE 28, 1984

HOUSE OF REPRESENTATIVES, COMMITTEE ON SCIENCE AND TECHNOLOGY, SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURAL RESEARCH, AND ENVIRONMENT, AND COMMITTEE ON AGRICULTURE, SUBCOMMITTEE ON DEPARTMENT OPERATIONS, RESEARCH, AND FOREIGN AGRICULTURE

Washington, DC.

The subcommittees met, pursuant to notice, at 9:38 a.m., in room 1302, Longworth House Office Building, Hon. George E. Brown, Jr. (chairman of the Subcommittee on Department Operations, Research, and Foreign Agriculture) presiding.

Present: From the Subcommittee on Department Operations, Research, and Foreign Agriculture: Representatives Brown (chairman); Olin, Roberts of Kansas; Gunderson, and Evans of Iowa. From the Subcommittee on NRARE: Representative Valentine.

Staff present: From the Subcommittee on Department Operations, Research, and Foreign Agriculture, William Stiles, subcommittee staff director Jack Fellows, congressional science fellow; Jerry Jorgensen, minority consultant; Anita Brown, staff assistant; and Glenda Temple, staff assistant. From the Subcommittee on NRARE: John Ratzel, minority technical consultant; Ronald Rahn, congressional science fellow; and Marty Ralston, staff assistant.

Mr. BROWN. The subcommittee will come to order. Subcommittee members are almost always late, but they are later than usual this morning because the House was in until after midnight last night.

I will take up a little bit of time this morning by making a short opening statement, and then we will start out with the witnesses.

Yesterday the subcommittees started these hearings with testimony from agricultural weather users and private sector weather producers, which I found to be extremely helpful to us. It renewed my feelings for the importance of good agricultural weather services to the health of our agricultural economy and to our entire economy.

Today we are going to move on to witnesses who will tell us what the various Federal agencies are doing and then some witnesses who will look at the future prospects for agricultural weather operations involving new technologies and means of operation. And finally, witnesses from the State of California will testify, to discuss the work that is being done out in the State of California.

We have found that there is a very considerable amount of interest in this subject, and we hope that these hearings can serve as a basis for making whatever changes may be required to increase the support for a sound agricultural weather service program. Quite conceivably, that can be done at least in part through modifications that we will make either in the Farm Act next year or in the legislation for the Weather Service, which we will also deal with in the Science Committee. But I hope the two committees can work cooperatively in order to achieve our goals in this subject.

Now, Congressman Scheuer, who chairs the Science Subcommittee dealing with this subject, has an opening statement. And in the event that he is not here personally to present that statement, I would like to have that statement in the record following my own statement. And if the minority ranking members have additional statements, we will include those in the record.

Now, our first panel I see are very perceptive and have already come to the table and are ready to go full steam ahead.

We would like to welcome all of you here this morning. The panel includes Dr. Richard Hallgren, who is Assistant Administrator of the National Weather Services; Dr. Denzil Clegg, who is Associate Administrator of the Extension Service, Science and Education Division of the Department of Agriculture; Dr. Roy Rauschkolb—and if I have mispronounced your name, you correct me, Doctor—director of the extension service at the University of Arizona.

Is that at Tucson?

Dr. Rauschkolb. Yes, sir.

Mr. Brown. Great city, Tucson. I am very fond of it.

Who is the anonymous individual?

Dr. Clegg. This is Dr. Norton Strommen, Chief Meteorologist with the USDA.

Mr. Brown. Oh, you brought some help along? [General laughter.]

Dr. Clegg. Yes, sir.

Mr. Brown. We are very pleased that all of you could be here, and we look forward to your testimony.

Dr. Hallgren, you may start, and, of course, the usual provisions apply. The full text of your statement will appear in the record, and you may add to or substract from it, as you see fit.

[The opening statements from Mr. Scheuer and Mr. McGratt follow:]

OPENING STATEMENT
BY
JAMES H. SCHEUER
ON
AGRICULTURE WEATHER HEARINGS JUNE 27-28, 1984

I AM PLEASED TO WELCOME OUR DISTINGUISHED GROUP OF WITNESSES WHO WILL PRESENT TESTIMONY ON THE STATUS OF OUR NATION'S AGRICULTURAL WEATHER SERVICES.

THE QUALITY AND WELL-BEING OF THESE SERVICES HAVE BEEN A MATTER OF CONCERN TO THE CONGRESS FOR SEVERAL YEARS.

TODAY WE ARE INTERESTED IN DEFINING THE ROLES OF THE PRIVATE SECTOR AND OF THE FEDERAL GOVERNMENT IN MAINTAINING AND IMPROVING THESE SERVICES.

AT HEARINGS HELD EARLIER THIS CONGRESS, WITNESSES URGED OUR SUBCOMMITTEE TO RESTORE FUNDING CUTS IN AGRICULTURAL WEATHER SERVICES WHICH WERE PROPOSED IN THE NOAA BUDGET BY THE ADMINISTRATION.

THE PROBLEM OF THE SUPPORT MECHANISM FOR THESE SERVICES PERSISTS.

CONSEQUENTLY, PRESSURES HAVE ACCUMULATED CALLING FOR A SEVERE RESTRICTION OF FEDERAL INVOLVEMENT, ON THE ONE HAND, AND THE DEVELOPMENT OF A DYNAMIC AND COMPREHENSIVE FEDERALLY SUPPORTED SYSTEM ON THE OTHER HAND.

THIS CONFLICT IS PART OF THE CONTINUING DEBATE AS TO WHETHER THE NATIONAL WEATHER SERVICE OR THE PRIVATE SECTOR IS BETTER EQUIPPED TO PROVIDE THESE SERVICES.

AT THE HEART OF THE MATTER IS THE QUESTION OF WHETHER A CONGRESSIONAL MANDATE FOR A NATIONAL AGRICULTURAL WEATHER SYSTEM IS REQUIRED IN ORDER FOR THE UNITED STATES TO MAINTAIN ITS COMPETITIVE SUPERIORITY IN AGRICULTURAL PRODUCTIVITY.

I EXPECT THAT THE TESTIMONY PRESENTED HERE TODAY AND TOMORROW WILL HELP US DECIDE HOW TO ACHIEVE THE PROPER BALANCE OF PRIVATE AND FEDERAL SERVICES WITHOUT EXCESSIVE COSTS TO THE FARMER OR TO THE TAXPAYER.

OPENING STATEMENT
THE HONORABLE RAYMOND J. MCGRATH

NRARE SUBCOMMITTEE
JOINT HEARING W/AGRICULTURE COMMITTEE
AGRICULTURAL WEATHER SERVICES

JUNE 27, 1984

THANK YOU, MR. CHAIRMAN. I WANT TO JOIN YOU IN WELCOMING OUR WITNESSES HERE THIS MORNING.

IN THE FIRST SESSION OF THIS CONGRESS, THE NATURAL RESOURCES SUBCOMMITTEE HAD THE OPPORTUNITY TO HEAR FIRST-HAND FROM GROWERS IN PALM BEACH COUNTY, FLORIDA, OF THE BENEFITS TO CONSUMERS ACROSS THE NATION FROM THE AGRICULTURAL WEATHER SERVICES. FROM A RELATIVELY SMALL FEDERAL INVESTMENT, BENEFITS IN THE FORM OF REDUCED CROP LOSSES AND HIGHER PRODUCTIVITY SAVE TENS OF MILLIONS OF DOLLARS EACH YEAR.

WE ARE HERE TODAY TO EXAMINE THE OPERATION OF THE NATION'S AGRICULTURAL WEATHER PROGRAMS. WE NEED TO INSURE THAT THE PROGRAMS ARE WELL-COORDINATED AND PROVIDE ACCURATE AND TIMELY INFORMATION TO FARMERS AND GROWERS.

I LOOK FORWARD TO THE TESTIMONY OF OUR WITNESSES AND ALSO WELCOME THEIR SUGGESTION FOR POSSIBLE AREAS OF IMPROVEMENT IN THE CURRENT PROGRAM.

STATEMENT OF DR. RICHARD E. HALLGREN, ASSISTANT ADMINISTRATOR FOR WEATHER SERVICES, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Dr. HALLGREN. Thank you, Mr. Chairman.

I hopefully will subtract from my statement, and I will try and summarize it. I will appreciate, of course, as you indicated, that the full text be included in the record.

I really appreciate the opportunity to be here before you today to discuss the agricultural weather services and advisory services of the National Weather Services.

This Nation has more severe weather and flooding than any other nation in the world, and sometimes that is for the good and sometimes it is for the bad. But I think that what has happened over the years is that all sectors of our economy have learned to live with that, and take advantage of it on some occasions and ameliorate the problems that it causes at other times. This is especially true in our agricultural sector. I think that our farmers use weather information as wisely as probably any other group of farmers in the whole world. And, while we can do much more in the future to enhance the capability of the farmers to use weather information, I can say that in my experience in the international arena, that all nations look to the United States for guidance and leadership as to how weather is integrated into the farming activities.

The mission of the Weather Service, way back in 1890, as defined in the Organic Act of that time, made it clear that we were to try and support the various sectors of our economy and our commercial interests with the best weather services that were possible. And weather services for agriculture have been a part, formally a part, of our service for the better part of a century.

We issue an overall general forecast for the entire country that helps both the farming and ranching communities in the many decisions that are weather related. And we try to use the infrastructure of the Weather Service in carrying out that overall task. In some States, or in some sectors or portions of the country, we do have an advisory service that is very specifically related to agriculture, and we have found that extremely useful. We base how useful it is on the responses that we get from the people that we serve in that area. When they are asking for more information, we generally know that our services are being used and are being used effectively, because that always brings to the surface the need for more services.

In some areas we also have fruit frost programs, issuing frost and freeze warnings. This is particularly true in California, Florida, and Texas where many crops are very highly sensitive to the temperature conditions, and, of course, particularly when they go substantially below 32 °F.

We also work at the national level in providing weather information that might affect the worldwide production of food and fiber, and we do that jointly with the—through a joint agricultural weather facility that is actually located in Department of Agriculture headquarters, and staffed by both people from the National Weather Services and the Department of Agriculture.

As you know, our budget over the last few years has proposed that the private sector assume a greater responsibility in this country for providing agricultural weather services. And under that particular system, the arrangement that has been proposed, the Weather Service would continue to provide forecasts that would be of benefit to the agricultural activity, but a very high percentage of it would be done through the private sector.

And this type of a partnership, or some variant thereof, is something that we have been working toward and has generally been a policy theme within the Weather Service here in the United States for many years. This Nation is the only nation in the world that really has a good private meteorological sector, and it is through the combined efforts of both the Federal meteorological service and the private meteorologists that the Nation can be best served.

I think it is extremely important that we find the right blend and the right mix of Federal and private services, so that the farmers are well-served across the whole Nation. Exactly what type it would be is one that we have to work out in the coming years so that all will benefit in the country.

The coordination of weather services, agricultural weather services, is a very complex matter. It is one that I think we do a pretty good job of today, but one in which there will always be room for improvement. It is a simple fact that the agricultural weather services just require interactions with many people. We have to know what the farmers need, we have to know the latest research results that are coming forth as to how to best handle the effects of weather on the crops. That means we have to work very closely with the land grant institutions, the extension service, and generally the Department of Agriculture.

We have to work with the media to get more effective dissemination of the forecasts related to agriculture. And we have to, of course, stay in close contact and work closely with the private sector so that they have all the information that is needed in order to carry out the agriculture weather services they provide to specific clients. This means that there has to be lots of coordination. We have to work very closely in doing that.

So I think that we do a fair job in that area, but I will always be one to say that we can improve it very substantially in the coming period. And I think these types of hearings help toward that end.

The agricultural and fruit frost programs of the Weather Service are highly integrated operations. What I have been trying to do is to make sure that we utilize all of our forecasters across the country in multiple tasks. That way we get down closer to the local level with people who are concerned about and knowledgeable about the agricultural needs and preparing forecasts that are at least partially tuned to the needs of the farmers. We have been saying that we do this through the cross-utilization of forecasters. In the course of the day, one part of the day they may be preparing a public forecast. At another time they may be issuing a vital severe weather or flood warning. At another time they may be preparing agricultural forecasts. But these can only be done effectively if you have full knowledge coming from like the agricultural

Weather Service centers as to what is most critical on this particular day or in the coming weeks, in order to make that system work well.

At the national level, we work very closely with the Department of Agriculture in ensuring cooperation, and in that area we will always have to stay in the closest touch if we are to be successful.

In general, on the Agricultural Research Institute's agriculture weather system plan, I basically applaud it and am very interested in it because I think it goes to the heart of trying to bring about more planning on a concerted basis, both between the Federal and the private sectors, as well as between all of the people that are involved in this whole process, as I mentioned earlier. And I think it would lead to a much higher level of coordination and lead to a definition as to how we have the overall system—how the overall system should work in the future.

With regard to the private sector, we have been working very closely with them, not just in agricultural meteorology but in many other areas as well. And we know that the best way is to have a balance of getting the best service out to all of the people, through a very close relationship and one in which we know what each other is doing and what each other should do.

They generally do best whenever they are serving a specific client, and that has been the policy of the National Weather Services for years, to not move into serving a specific client, but only serving the general sectors of the economy with agriculture—with weather services, and in this particular case, agricultural weather services.

Just last year we had a number of conferences in which we invited all of the firms that were in the American Meteorological Society's professional directory. We had one in Kansas City, we had one in Florida, we had one in Utah and one in Indiana. And through these types of conferences we were trying to bring a better awareness to the private sector as to what we do and to try and learn more precisely what they feel they can do best. And I think that they served a useful purpose.

I would just like to add that I just returned from Switzerland over the weekend. I am the Permanent Representative of the United States to the World Meteorological Organization. And one of the major topics at every one of those meetings is agricultural weather services on a worldwide basis. It is very clear to me that in each of the developing countries the agricultural weather service is the most important service that those particular weather services are rendering. And it is one that cuts across not just providing forecasts, but using the climatology of the past very wisely.

It is extremely gratifying to see the number of people in these particular countries that had their original training here in the United States, very frequently spending part of their time in some university studying meteorology and part of the time in the Department of Agriculture.

On a worldwide basis we simply have to do a good job, a better job than we are today, in providing agricultural weather service if we are going to feed the people of this world in the future.

That is all I have. It is a general summary of what is in my testimony, the prepared text. And if you have any questions at a later time, I will be pleased to answer them.

Thank you.

[The prepared statement of Dr. Hallgren follows:]

STATEMENT OF
DR. RICHARD E. HALLGREN
ASSISTANT ADMINISTRATOR FOR WEATHER SERVICES
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
UNITED STATES DEPARTMENT OF COMMERCE
BEFORE THE
SUBCOMMITTEE ON DEPARTMENT OPERATIONS, RESEARCH, AND FOREIGN AGRICULTURE
HOUSE COMMITTEE ON AGRICULTURE
AND THE
SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURAL RESEARCH, AND ENVIRONMENT
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
JUNE 28, 1984

Mr. Chairman and Members of the Committees, I appreciate the opportunity to appear before you today to discuss the agricultural weather forecast and advisory services of the National Weather Service.

The United States has the widest variety of weather and flood conditions, and the greatest incidence of severe weather, of any nation in the world. Further, the vulnerability of the U.S. population to weather-related dangers is growing steadily, due to demographic, economic, social, and technological trends. Our Nation's diverse governmental and commercial sectors have the ability to exploit weather information, however, using it to avert disastrous loss of life and property in natural calamaties, and to adjust production activities to achieve maximum performance from our economy. This is especially true of the agriculture sector.

The mission of the National Weather Service is essentially unchanged from that which was stipulated in the Organic Act of 1890. This mission, as listed in 15 U.S.C. 313, and as clarified in OMB Circular A-62, is to provide basic weather services needed by the general public for the protection of life and property and the advancement of the Nation's commercial interests, and for the mission needs of other agencies.

Weather services for agriculture have been an intrinsic part of our service for nearly a century. We currently provide broadscale forecasts and warnings to farming and ranching communities in many states to aid decisions on planting, harvesting, irrigating, chemical use, labor scheduling, and other agricultural operations. In a subset of those states we perform weather advisory services, relating the expected weather to the potential farming operations to describe the general impact and possible alternative actions. These advisory services depend on coordination with State Cooperative Extension experts, and result in routine weather advisory bulletins, and cooperative technical studies and farmer-education programs. Observations of agriculturally significant weather elements are collected in farm areas to support the forecasts and advisories and are exchanged with various governmental agencies and cooperating firms. Products of the general agriculture program are issued daily and cover individual states or climatically-homogeneous zones within states.

Under the more specific fruit frost program, frost and freeze warnings and advisories are provided to agriculture communities in California, Florida, and Texas where fruit and vegetable crops are highly sensitive to below freezing temperatures. These products pertain to specific points that are representatve of the farms and groves within the areas served.

Additionally, analyses and projections of weather conditions that affect the worldwide production of food and fiber are created by National Weather Service meteorologists in the Joint Agricultural Weather Facility in USDA Headquarters. This weather information is the basis for crop assessments performed by the USDA agricultural meteorologists in the Joint Facility and used in the total program of estimating acreage, yield and production.

Our current budget proposes that the private sector assume responsibility for providing agricultural weather services in the farming areas which need them. The National Weather Service will continue to provide more general weather information which supports agriculture activities, and cooperate with the agricultural weather activities of other agencies. We are proposing this for two reasons. First, general revenues should be used to provide general forecasts and not specialized services for a particular industry such as agriculture. Second, private sector meteorology is becoming a highly sophisticated field capable of providing farmers across the nation with good specialized weather guidance. We welcome the growth of this field, and look forward to development of partnership in which we provide forecasts for the general public, and an extensive base of weather data from which the private sector produces more specialized weather guidance to meet the needs of specific farming interests. I shall refer to the private/public sector partnership throughout the course of my remarks.

Mr. Chairman, I have given you this quick picture of our overall mission and the specific services for agriculture to serve as background. Now I would like to address the hearing objectives specifically.

The reliability, coordination, and efficiency of the existing federal agricultural weather operations:

The diversity of agricultural services has led more than one of my foreign colleagues to note that the U.S. is both blessed and damned by our wealth in this area. We are blessed because we have such advanced and widespread scientific knowledge of the relationship between hydrometeorology and the biosphere; we are blessed because our free market system spurs an incredible technology pump that permits the relatively inexpensive implementation of knowledge to occur in a fraction of the time it takes elsewhere; and we are blessed because our farmers have access to multiple sources of information.

But, in this line of thinking, we are damned because our competitiveness has inhibited our academic, commercial, and governmental entities from sharing responsibilities for research, operations, and education; damned because the size of our knowledge base is too large to assimilate effectively! Now, Mr. Chairman, I don't really agree with this assessment of our Nation's agricultural weather services, but there are some complexities that can be confusing. Looking just at the National Weather Service, let me expand on this idea.

Agricultural and fruit frost programs are supported by the integration of round-the-clock observations, analyses, and forecasts that are provided by the full warning and forecast structure of the Service. To achieve the breadth of forecast and advisory coverage across the country we now use a mix of cross-utilized forecasters and dedicated forecasters in Weather Service Forecast Offices, Weather Service Offices, and Agricultural Weather Service Offices. I have organized the services in areas where agricultural production is most responsive to weather inputs and where the needs have been articulated. I think this has been an efficient way to discharge our mission responsibilities. But as I've mentioned these broad services and products are just the kernel of an extensive and complex mixture of private sector information services provided by commercial and not-for-profit firms.

Coordination between the Department of Commerce and the Department of Agriculture is accomplished under an Interagency Agreement signed by Secretaries Baldrige and Block early last year. Two Subsidiary Agreements have been enacted, essentially clarifying the roles of the agencies regarding crop assessment responsibility. Representatives of each of the Departments also co-chair a working group under the Office of the Federal Coordinator for Meteorological Services and Supporting Research. This working group was formed specifically to update the Federal Plan for Agricultural Weather Services. We must now move to an even higher level of cooperation across the Federal, state, and private sectors to assist the agriculture industry in identifying services needed and in providing technical assistance to meet those needs.

The Agricultural Research Institute's proposed agriculture weather system plan:

I am very interested in the proposals of various groups that have grappled with this complex problem. It is important that we come together with a sound public/private partnership, given that certain "core" services are provided by the Government and "value-added" services are provided by the private sector. The Agricultural Research Institute deserves a great deal of credit for its tenacity in roughing-out and honing a concept that could provide a good balance of local requirements and Federal resources for services. My concerns are for continuity of services to farmers. We must assure a smooth transition to the National or regional weather information system of the future. I will be glad to participate in and provide support to good cooperative arrangements.

The ability of the private sector to complement and support a national agriculture weather system:

Mr. Chairman, earlier I described the services and products of the National Weather Service. You'll recall they are primarily focused on the general needs of an agricultural community instead of providing tailored forecast and advisory services directed to a specific user. As I have mentioned, -- and will increasingly be -- to encourage our policy is and cooperate with private meteorological companies to provide these value-added, specialized services.

This is already occuring in several ways:

- some firms are providing services to individual farms -- especially large, corporate farms ;
- some firms provide services for municipal agencies such as air quality boards or agricultural commissions; and,
- a number of commodity marketing firms employ meteorologists or contract with private meteorological firms.

The latter case actually exemplifies weather impact support for economic planning and decision making, rather than weather forecast support for production purposes.

Also, we have always been heavily dependent on the private sector to disseminate weather information to users. When a farmer hears that the next three days should bring excellent haying conditions, he is on the receiving end of a dissemination pipeline that typically originates with National Weather Service information and is transmitted to commercial news disseminators, not-for-profit farm organizations, farm broadcast companies, and private meteorological firms via the NOAA Weather Wire Service or other communications links. This non-Federal dissemination of weather information is a substantially large private sector enterprise.

Last fall we sponsored a conference series to incorm private sector meteorology of the products and services now provided by our agriculture, fruit frost and fire weather programs. We invited all the 91 firms listed in the Professional Directory of the Bulletin of the American Meteorological

Society, and held one-day conferences in Kansas City, Missouri; Ruskin (Tampa Bay Area), Florida; Salt Lake City, Utah; and West Lafayette, Indiana. Through these conferences we were able to identify and correct a number of stumbling blocks our private sector colleagues faced in accessing our data and products.

The government, private sector, academic, and user requirements and advice for a national agriculture weather system:

Mr. Chairman, although the U.S. has an impressive agriculture weather system there are many areas to improve. I am eager to assist in making real improvements. I think it is most appropriate for the various user groups to state their requirements. The diversity of climates, agricultural commodities and practices occurs in space and time, making the articulation of consistent, comprehensive requirements quite difficult. But, a strong Federal/state/private sector partnership can pinpoint the requirements and develop the necessary services.

This concludes my statement. If you have any questions, I will respond to them here or provide them for the record.

Mr. **Brown**. Thank you very much, Dr. Hallgren.

We will hear all of the panel members before we ask questions.

Dr. Clegg, would you like to go ahead and give us your statement at this point?

STATEMENT OF DR. DENZIL O. CLEGG, ASSOCIATE ADMINISTRATOR, EXTENSION SERVICE, SCIENCE AND EDUCATION, U.S. DEPARTMENT OF AGRICULTURE, ACCOMPANIED BY DR. NORTON D. STROMMEN, CHIEF METEOROLOGIST, U.S. DEPARTMENT OF AGRICULTURE

Dr. **Clegg**. Thank you, Mr. Chairman, for the opportunity to share with you some thoughts concerning the importance of weather to agriculture. I am pleased to be able to participate with this panel, and especially have one of our partners representing the State land grant system, Dr. Roy Rouschkolb, and my colleague in USDA, Dr. Norton Strommen.

The U.S. food and agricultural production system is recognized worldwide for its accomplishments, achieved through the farmers' ability to apply evolving technology. Weather data and climate information are two important elements used by the farmers in short- and long-term operations and decisionmaking.

Weather information is used in making decisions that reduce losses and improve efficiency. These decisions can minimize avoidable agricultural losses, and are made on the basis of timely and accurate weather forecasts or climatological analysis of historical data.

Currently, systems are dedicated to supporting agricultural needs and weather forecast warning needs. The basic Federal observation and forecast program relies on a network of macro and meso observations. Additional parameters: soil temperature, solar radiation, evaporation, soil moisture and others are also used to support agricultural weather predictions.

Agriculture's needs for timely weather and climate information has been well documented. I won't go through these, but they are in my testimony.

In 1940 the Weather Bureau was transferred from USDA where it had resided since the Organic Act of 1890. Under this arrangement, the Department of Commerce agreed to provide necessary weather services to agriculture. This has led to many cooperative efforts between the Departments of Agriculture and Commerce.

The diversity of American agriculture often requires weather information be tailored to local needs at the meso and micro scale. For example, each crop responds differently to relatively small variations in weather. At the same time these variations cause significant changes in other parts of the biosphere such as insect and disease development, which have a great impact on agricultural production and on profits.

Agricultural weather is a relatively new science, but it has already shown great potential for improving the productivity of American agriculture. Research and pilot projects throughout the United States show the benefits to our economy could be significant. For example, local weather data from areas where crops are grown can be used to drive computer models that predict if a certain insect can or cannot be present and if present, what may be expected to happen. This can reduce the amount of pesticides used. Similarly, recent studies have shown that savings of more than $500 million annually could be realized in connection with timely application of herbicides. Annual savings of $45 million were shown to be possible in one State alone by using weather information to schedule irrigation.

Timely, complete, and accurate agricultural weather information is used by Government agencies—to plan supply and distribution programs; by Federal, State, and private researchers—to disseminate impacts of weather on the biological sphere; public and private advisors—to provide recommendations needed by farmers for efficient production; and producers—to enable them to make production and marketing decisions that are influenced by the weather.

Existing agricultural weather programs are best described as cooperative efforts between the Department of Commerce and the USDA, the States and the private sector. This cooperation has resulted in a variable program coverage in the dissemination of key information and in educational efforts to improve transfer of new technology. While education for new applications is the primary effort for extension, we also assist in the dissemination of weather and climate information. The private sector, through its role in communications and specific forecasting applications, can and is meeting emerging needs. The primary thrust is in the form of computer and advanced communications systems. For example, private consulting groups now provide specialized weather climate data analysis for farmers. The Department encourages this development to continue. As has been advocated by the administration, the primary Federal responsibility is the maintenance of a nationwide network of macro and meso scale observation and forecasting that provides the basis of the general forecasts and severe storm warnings.

Some examples of programs underway, and these could be many, but some are: The Michigan Crop-Pest Reporting System, a cooperative effort between Michigan State University and the Michigan Department of Agriculture, with contributions from NOAA and USDA. The Nebraska Automated Data Weather Network and AGNET, a demonstration project under the National Climate Program's intergovernmental work has focused on water conservation through more efficient irrigation scheduling. The Florida Agricultural Science and Technology System, the FAST system, is a leader for the dissemination of satellite data information. There are projects in other States, each with its own unique emphasis. The one aspect that stands out in all the programs is cooperation between Federal, State, regional, and local public and private organizations. Regional, State, and Land Grant University programs compliment Federal programs.

I would like to list here briefly some of the programs in the USDA. The Agricultural Research Service and the Cooperative State Research Service are involved with research that is strongly influenced by weather and must measure the impact of weather on various agricultural functions. The Animal and Plant Health Inspection Service is involved in various survey, control, and eradication programs that are heavily influenced by weather. Climatological data are important in planning the timing of control programs or eradication efforts, and timely weather information is needed to carry them out.

The Extension Service, working with State Cooperative Extension Services and Land Grant Universities, and cooperating with the National Weather Services is facilitating development of agricultural weather networks in several States to obtain real-time weather data that provides "ground truth" needed by forecasters and the localized information needed by agricultural specialists to develop weather-based recommendations on insect and disease control and irrigation and other areas.

The Statistical Reporting Service requires accurate, timely data for their cooperative weekly weather and crop program.

The World Agricultural Outlook Board needs weather and climatological data to support its preseason U.S. crop production estimates and monitoring for crop conditions between the monthly food and fiber production forecasts. This is accomplished through the Joint Agricultural Weather Facility.

The Forest Service and its cooperators use weather and climate information in operational management of several billion acres of U.S. forest and range lands. Areas of use include forest fire management, air and water resource management, forest pest management, and timber management. The Forest Service cooperates with other Federal, State, and local agencies in managing an extensive network of weather and climate monitoring sites located in wildland areas. Research efforts involve determination of weather and climate impacts on management of all forest and range land resources in the United States.

The Agricultural Stabilization and Conservation Service makes extensive use of climate data in certification of disaster relief eligibility and management programs.

The Soil Conservation Service cooperates with a snow survey program to prepare estimates of water availability related to spring and summer stream flow in 11 Western States and Alaska. In addition, climatic data are required for soil taxonomy, long- and short-term conservation program planning, and the determination of conservation research requirements.

The Climate and Weather Coordinating Committee for USDA plays an important role in identifying agency needs and providing liaison to other Federal programs.

Establishing a viable agricultural weather program to serve the needs of producers, the research and extension community, and Government will require support and cooperation from the Federal, State, and local levels, each doing what it can do best.

Future improvements in Agricultural Weather Services can evolve in many forms. Clearly, a program that has the potential to serve the varied user needs that have been identified must be flexible. Even more important, the program must provide for joint program planning between Federal, State, and local governments in the private sector. Each has a contribution to make. The USDA would encourage efforts for development of a fully coordinated plan. Such an effort should provide for an orderly transition within the framework of existing programs.

This concludes my testimony. I will be glad to respond to any questions that you may have.

[The prepared statement of Dr. Clegg follows:]

STATEMENT OF

DR. DENZIL O. CLEGG

ASSOCIATE ADMINISTRATOR

OF

EXTENSION SERVICE

BEFORE THE

SUBCOMMITTEE ON DEPARTMENT OPERATIONS, RESEARCH, AND FOREIGN AGRICULTURE

OF THE

COMMITTEE ON AGRICULTURE

AND

SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH, AND ENVIRONMENT

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

JUNE 28, 1984

Weather Testimony

Introduction

Mr. Chairman, thank you for the opportunity to share with you some thoughts concerning the importance of weather to agriculture. The U.S. food and agricultural production system is recognized worldwide for its accomplishments, achieved through the farmers' ability to apply evolving technology. Weather data and climate information are two important elements used by the farmers in short- and long-term operations and decisionmaking.

Weather information is used in making decisions that reduce losses and improve efficiency. These decisions can minimize avoidable agricultural losses and are made on the bases of timely and accurate weather forecasts or climatological analysis of historical data.

Currently systems are dedicated to supporting agricultural needs and weather forecast-warning needs. The basic Federal observation and forecast program relies on a network of macro and meso observations. Additional parameters, i.e. soil temperature, solar radiation, evaporation, and soil moisture are also used to support agricultural weather predictions.

Agriculture's needs for timely weather and climate information has been well documented by the following: The National Academy of Sciences report in 1980, known as the BARR report, gives detailed examples of avoidable agricultural losses through use of weather forecasts for short-term decisions and also in long-term planning through the use of historical data. The General Accounting Office report, "Agricultural Weather Information Is Not Effectively Disseminated to Farmers," calls for improving our weather information system. A "Report to the President on Integrated Pest Management" cites weather as a critical input to this nationwide effort.

In 1940 the Weather Bureau was transferred from USDA where it had resided since the Organic Act of 1890. Under the transfer arrangement, DOC agreed to provide necessary weather services to agriculture. This has led to many cooperative efforts between the Departments of Agriculture and Commerce.

The diversity of American agriculture often requires weather information be tailored to local needs at the meso and micro scale. For example, each crop responds differently to relatively small variations in weather. At the same time these small variations cause significant changes in other parts of the biosphere such as insect and disease development, which have a great impact on agricultural production and on profits.

Agricultural weather is a relatively new science, but has already shown great potential for improving the productivity of American agriculture. Research and pilot projects throughout the United States show the benefits to our economy could be significant. For example, local weather data from the areas where crops are grown can be used to drive computer models that predict if a certain insect can or cannot be present and if present what may be expected to happen. This can reduce the amount of pesticides used. Similarly, recent studies have shown that savings of more than $500 million annually could be realized in connection with timely application of herbicides. Annual savings of $45 million were shown to be possible in one state alone by using weather information to schedule irrigation.

Timely, complete, and accurate agricultural weather information is used by Government agencies--to plan supply and distribution programs; Federal, State and private researchers--to determine impacts of weather on the biological sphere; public and private advisors--to provide recommendations needed by farmers for efficient production; and producers--to enable them to make production and marketing decisions that are influenced by the weather.

Existing agricultural weather programs are best described as cooperative efforts between the Department of Commerce, USDA, the states and the private sector. This cooperation has resulted in a variable program coverage in the dissemination of key information and in educational efforts to improve transfer of new technology. While education for new applications is the primary effort for Extension, we also assist in the desemination of weather and climate information. The private sector, through its role in communications and specific forecasting applications can and is meeting emerging needs. The primary thrust is in the form of computer and advanced communications systems. For example, private consulting groups now provide specialized weather and climate data analysis for farmers. The Department encourages this development to continue. As has been advocated by the Administration the primary Federal responsibility is in the maintenance of a nationwide macro and meso scale observation and forecasting network that provides the basis of the general forecasts and severe storm warnings.

Examples of Programs Underway

Programs demonstrating the effectiveness of the various components of a fully operational agricultural weather program are being conducted in several areas. Some examples of these efforts are: The Michigan Crop-Pest Reporting System, a cooperative effort between Michigan State University and the Michigan Department of Agriculture with contributions from NOAA and USDA. The Nebraska Automated Weather Data Network and AGNET, a demonstration project under the National Climate Program's intergovernmental work has focused on water conservation through more efficient irrigation scheduling. The Florida Agricultural Science and Technology System (FAST) is a leader for dissemination of satellite data and information. There are projects in other states each with its own unique emphasis. The one aspect that stands out in all the programs is cooperation between Federal, Regional, State and local public and private organizations. Regional, State and Land Grant Universities programs compliment Federal programs.

Programs of USDA Agencies

The Agricultural Research Service (ARS) and the Cooperative State Research Service (CSRS) are involved with research that is strongly influenced by weather and must measure the impact of weather on various agricultural functions.

The Animal and Plant Health Inspection Service (APHIS) is involved in various survey, control, and eradication programs that are heavily influenced by weather. Climatological data are important in planning the timing of control programs or eradication efforts, and timely weather information is needed to carry them out.

The Extension Service (ES), working with State Cooperative Extension Service (SCES) of the Land Grant Universities, and cooperating with the National Weather Service is facilitating development of agricultural weather networks in several states to obtain real-time weather data that provides "ground truth" needed by forecasters and the localized information needed by agricultural specialists to develop weather-based recommendations on insect and disease control and irrigation.

The Statistical Reporting Service (SRS) requires accurate, timely data for their cooperative weekly weather and crop program.

The World Agricultural Outlook Board (WAOB) needs weather and climatological data to produce its pre-season U.S. crop production estimates and monitoring for crop conditions between the monthly food and fiber production forecasts. This is accomplished through the Joint Agricultural Weather Facility (JAWF).

The Forest Service (FS) and its cooperators use weather and climate information in operational management of several billion acres of U.S. forest and range lands. Areas of use include forest fire management, air and water resource management, forest pest management, and timber management. FS cooperates with other Federal, State, and local agencies in managing an extensive network of weather and climate monitoring sites located in wild-land areas. Research efforts involve determination of weather and climate impacts on management of all forest and range land resources in the United States.

The Agricultural Stabilization and Conservation Service (ASCS) makes extensive use of climate data in certification of disaster relief eligibility and management programs.

The Soil Conservation Service (SCS) operates a cooperative snow survey program to prepare estimates of water availability related to spring and summer stream flow in 11 western states and Alaska. In addition, climatic data are required for soil taxonomy, long- and short-term conservation program planning, and the determination of conservation research requirements.

The Climate and Weather Coordinating Committee for USDA plays an important role in identifying agency needs and providing liaison to other Federal programs.

Establishing a Viable Agricultural Weather Program

Establishing a viable agricultural weather program to serve the needs of producers, the research and extension community, and government will require support and cooperation from the Federal, State, and local levels, each doing what it can do best.

Future improvements in Agricultural Weather Services can evolve in many forms. Clearly a program that has the potential to serve the varied user needs that have been identified must be flexible. Even more important, the program must provide for joint program planning between Federal, State and local governments and the private sector. Each has a contribution to make. The USDA would encourage efforts for development of a fully coordinanted plan. Such an effort should provide for a orderly transition within the framework of existing programs.

This concludes my testimony. I'd be glad to respond to any questions you have at this time.

Mr. **Brown**. Thank you very much, Dr. Clegg.
Dr. Rauschkolb.

STATEMENT OF DR. ROY S. RAUSCHKOLB, DIRECTOR OF COOPERATIVE EXTENSION, UNIVERSITY OF ARIZONA

Dr. **Rauschkolb**. Yes, sir; thank you very much.

Mr. Chairman, members of the subcommittees, my interest in real-time weather network establishment dates back several years, from when I was in California which, I might say, is also a nice place to be. When I was working for the University of California, I was involved in the initiation of the real-time weather network which now exists in that State with the support of the Department of Water Resources. I will try to summarize my testimony and get into some policy issues which you asked to be identified, which I think came about as a result of implementing or attempting to implement a real-time weather network in Arizona.

It is my belief that we are on the verge of a major technological advance in the development and application of and utilization of real-time weather in agriculture and other uses. We all recognize the high level of sensitivity of biological and physical systems to meteorological variables. As many of you in these hearing committees have already stated, there is need for an integrated national system of real-time meteorological data collection and dissemination for the benefit of a wide variety of uses and users.

In my view, it is essential for the development of value-added applications by private industry and academia, research, education, and for verification of current forecasting methodologies.

My purpose here today is to outline a climatic data collection, dissemination and education program we are implementing in Arizona, in hopes that it will provide some insight as to the effort and interest of various States in such a program, and might suggest some national policies that you might wish to implement in order to facilitate the development of a coordinated, integrated, national network which would allow users to more effectively manage their soil, water and material resources for the benefit of the resources and the consumer.

In Arizona, we had several factors which led us to be very much interested in the development of such a system. We had a management system which allowed us to—or a need, basically, to utilize substantially more and more highly sophisticated data and processes for helping our producers make management decisions. In addition, there was an overriding factor of limited water resources which we had in the State. We also had a capability of collecting, interpreting, disseminating, integrating, and utilizing a multiplicity of data through the use of a recently established statewide computer network in cooperative extension. In addition to that, our clientele were requesting assistance in solving management problems that could only be managed through a more sophisticated approach to analyzing the situation. For example, the growing degree-day relationships are used to predict crop growth or diseases or insect infestation. But the gross data now available through the use of maximum and minimum temperatures did not provide the level of precision needed to make accurate predictions of probable impact and the need for control of pests.

If you will turn to figure 1, I have an example here of the actual temperature data for a summer day in Arizona, and it shows the ambient air temperature for different times of the day, and you can see that the—if one were to simply look only at the maximum and minimum temperature, that this does not describe what an organism is experiencing during a 24-hour period.

The curves in figure 2 demonstrate what happens when one attempts to use these data to make some prediction of probable response. If you will refer to figure 2, you will see relative plant growth plotted versus time in days. The upper dash line indicates historical data for highest maximum temperature. The lowest dashed line represents historical data for lowest maximum temperature. And the solid line in the center represents the probable response for the normal, or for the mean of the historical period.

If one then takes a look at a forecast at some point in time, and say that there is a high, normal and low temperature probability, then you can see that there is a wide range of possible response to a forecast, and the result is a very low prediction accuracy.

Conversely, if you look at figure 3, where plant growth is plotted versus time in days, and we correlate plant growth with real-time weather data, so that we know at what point in time the plant is—the temperature is—what the temperature is for any given point in time so that the plant, you can actually calculate the plant response. Then for the same forecast possibilities we have a much narrower range of probable response, and therefore we can have a greater prediction accuracy. And this is the kind of sophistication that is needed in terms of looking at disease or insect incidence or crop phenology.

The ability to use weather forecasts to predict biological response is limited by virtue of the wide range of possibilities, as I have indicated. With these and other factors in mind, it was determined that Arizona needed a real-time weather network to provide the necessary data to enhance our ability to assist producers in making their management decisions.

And with the involvement of a number of organizations and individuals, Statewide Meteorological Advisory Committee, the University of Arizona, State climatologists, and a regional HATCH project, a proposal was developed for establishment of a real-time weather network. Among the objectives was the coordination, on a regional basis, with other States in the West which were in various stages of developing their own networks.

The proposal, when we developed it, was planned to be submitted to the National Climate Program Office as well as our State legislature for funding. There was no such network in Arizona supported either by public or private organizations. And neither was there any regional effort as far as we were able to establish, or even a contemplation for establishing such a network.

Because of the indications of support by the university and the legislative decisionmakers, and the recognition that the National Climate Program Office really lacked adequate funds to be able to support this effort, we decided to only pursue the legislative funding avenue.

We were successful in receiving funding from the State legislature, and it was part of a network and a concerted statewide effort to improve water use efficiency. The network will be funded effective the first of July, and with automated weather stations to be located throughout the State. And after consulting with agents, specialists, extension faculty, ARS and commodity groups, and a variety of individuals as to the best location for those stations.

The stations will be capable of collecting meteorological information for several variables simultaneously, transmitting the data to the central computer for condensing and formatting for use in a variety of predictive and decision-aiding models as well as in educational programming on the use of these data.

I have here an outline, or I have outlined a few of the items which bioclimatologists in extension will be assisting in. And these efforts will be part of an integrated system to provide an intra-State data base on meteorological data which may be accessed by a variety of users, and use in educational programs to help us provide more sophisticated solutions to problems our clientele are facing.

It is our feeling that these and similar data will also enhance the historical record and forecasting abilities of the National Weather Services if there were a method for these data to be collected and utilized by them. While the University of Arizona is supporting this effort, we recognize that other sources of similar data will not be part of the network. We need to have a mechanism whereby these data can be accessed and utilized. And we will be working with a variety of advisory groups and coordinating committees in order to facilitate these interactions and sharing of data.

In addition to this, in order to accomplish this effort, there are a variety of issues to be considered that require policy decisions. One is the design of a real-time data collection system where we have automated data collection, do we use satellites for data collection? Some States don't have ready access to satellites for transmittal of data. Should we have a distributed host linked to a central data collection or do we have a central host?

As far as the central data base is concerned, which variables do we measure? What quality of data do we have? For example, what do we do about data gaps? How is the data to be formatted? Some users need 15-second intervals; some may need 15-minute intervals; some may need only 4-hour intervals. A number of reporting stations that are a minimum to be part of a network and the cost, if there is any, of accessing the data is another issue. In terms of location of the stations, who decides where the stations are located, and who is responsible for their maintenance?

In terms of education of users, who is the end user: Individuals, a university, or private industry? And an end user from our perspective is not just agriculture. There are a number of other uses. Who conducts educational programs for the users and who develops the predictive and decision-aid models? How do you make this data available for State, regional and national data base centers, from an archival point of view, from a forecast enhancement point of view? Who owns the raw data in a regional network? For example, if we input the data, do we have only access to the raw data we input, or do we have access to all the raw data? What will be the role and priority for NOAA in a real-time weather network, and what is the need for a national network?

In conclusion, then, I would just go on to say that your leadership and support in the development of a regional and national meteorological data collection and dissemination network would contribute greatly to the application of this technology to what I view as a very high technology industry, agriculture.

[The prepared statement and biographical sketch of Dr. Rauschkolb follows:]

PRESENTATION BEFORE

THE COMMITTEE ON AGRICULTURE:

SUBCOMMITTEE ON DEPARTMENT OPERATIONS, RESEARCH AND FOREIGN AGRICULTURE

AND

THE COMMITTEE ON SCIENCE AND TECHNOLOGY:

SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT

IMPLEMENTATION OF A "REAL-TIME" WEATHER NETWORK IN ARIZONA

BY

DR. ROY S. RAUSCHKOLB

DIRECTOR OF COOPERATIVE EXTENSION
UNIVERSITY OF ARIZONA

25 June 84

It is my belief that we are on the verge of a major technological advance in the developmet of a "real-time" weather network. We all recognize the high level of sensitivity of biological and physical systems to changes in meteorological variables. As many of you on these hearing committees have already stated, there is a need for an integrated national system of real-time meteorological data collection and dissemination for the benefit of a wide variety of uses and users. It is essential for development of value added applications by private industry and academia, research, education and verification of current forecasting methodologies.

My purpose here today is to outline a climatic data collection and dissemination program we are implementing in Arizona.This will provide you with some insight as to the effort and interests of the various states in such a program. In turn, this may suggest some national policies that you would wish to implement in order to facilitate the development of a coordinated and intergrated national network that allows users to more effectively manage their soil, water and material resources for the benefit of those resources and the consumer.

The need in Arizona existed because of a combination of several factors at this point in time that required us to become more effective in our resource, management and allowed us to utilize substantially more and sophisticated data for helping our producers make management decisions. Besides the obvious overriding factor of limited water resources we also had the capability of collecting, interpreting, disseminating, intergrating and utilizing a multiplicity of data through the use of our recently established statewide computer network in Cooperative Extension.

In addition, our clientele were requesting assistance in solving management problems that could only be solved by a more sophisticated approach to analyzing the situation. For example, the growing degree-day relationship is used to predict crop growth and disease or insect infestation. But the gross data now available through the use of maximum and mimimum temperatures does not provide the level of precision needed to make accurate predictions of probable impact and need for control of the pest.

If one examines Figure 1, one can see an acutual temperature curve for a summer day in Arizona. Recognizing the sensitivty of biological systems to temperature variation, it is not difficult to imagine how simply using the highest and lowest temperature for the day does not describe what any organism experiences.

The curves in Figure 2 demonstrate what happens when one attempts to use these data to make some prediction of probable response. Since one currently must rely on daily ranges and historical means as a basis for determining the response of an organism to its environment, the ability to use a weather forecast to predict a biological response is limited by virtue of the wide range of possiblities. By using real-time data as shown in Figure 3 one is able to more percisely calculate the actual response of an organism to the environment and thereby narrow the range of responses that might be predicted by use of a weather forecast.

With these, as well as other factors in mind, it was determined that Arizona needed a real-time weather network to provide the type of data necessary to enhance our abiltiy to assist producers in making their management decisions.With the support of a statewide Meteorological Advisory Committee, several departments at the University of Arizona, the State Climatologist, and the Western Regional Coordination Committee (WRCC 47) on Climatic Information for Agriculture and Natural Resources, a proposal was developed for the establishment of a statewide real-time weather network. Among the objectives was the coordination on a regional basis with other states in the west which were in various stages of developing their own weather networks. The proposal was to be submitted to the National Climate Program Office (NCPO) and our State Legislature for funding. No such network existed in Arizona supported either by public or private organizations. Neither was there any regional effort or contemplation of establishing such a network.

Because of the indications of support by the University of Arizona and Legislative decision makers and a recognition of the limited funding available to the NCPO we decided only to pursue the former funding avenue. We were successful in receiving funding from the State Legislature for the implementation of a real-time weather network as part of a concerted statewide effort to improve the water use efficiency.

The network will be funded effective July 1, 1984. Automated weather stations will be located throughout the state after consultation with extension agents and specialists, experiment station faculty, ARS researchers at the Water

Conservation Laboratory in Phoenix, Arizona, commodity groups, the Statewide Meteorological Advisory Committee and the State Climatologist. These stations will be capable of collecting meteorological information on several variables simultaneously and transmitting that data to a central computer for condensing and formatting for use in a variety of predictive and decision aid models as well as in educational programming on the use of these data.

As part of the decision package an Extension Biometeorologist will be employed to augment the existing University faculty in the areas of:

1. Elucidation of principles in cause and effect relationships between biological and physical phenomena and selected meteorolgical variables.

2. Verification and correlation of these relationships in the field.

3. Development of predictive and decision aid models dependent upon meteorological data.

4. To interact with private consultants,industry and commodity groups to assist them in accessing the data and to reach others that these groups can not or will not be able to reach.

These efforts will be part of an integrated system to provide an intrastate data base on meteorological data which may be accessed by a variety of users. This also will facilitate an educational program designed to permit us to provide more sophisticated solutions to problems our clientele are facing. For the first time we will have high quality data for a number of locations with a high time resolution. It is our feeling that these and like data can also enhance the historical record and the forecasting abilities of the National Weather Service if there were a mechnism for these data to be collected and utilized by them.

While the University of Arizona is supporting this effort we recognize that there are other sources of similar data that will not be part of the network. Other data sources need to have a mechanism where their data can be accessed utilized. We will be working through our advisory groups and coordinating committees to try and facilitate these interactions and sharing of data.

This concludes my formal remarks. I would be pleased to respond to any questions you may have.

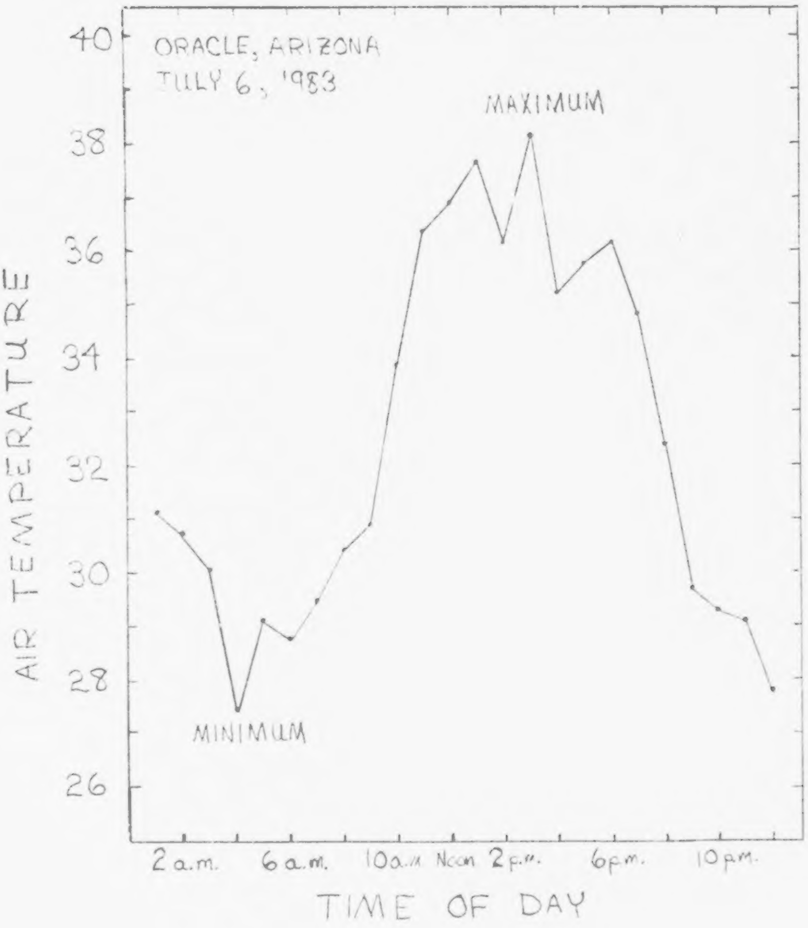

Figure 1:

The diurnal ambient air temperature at Oracle, Arizona.

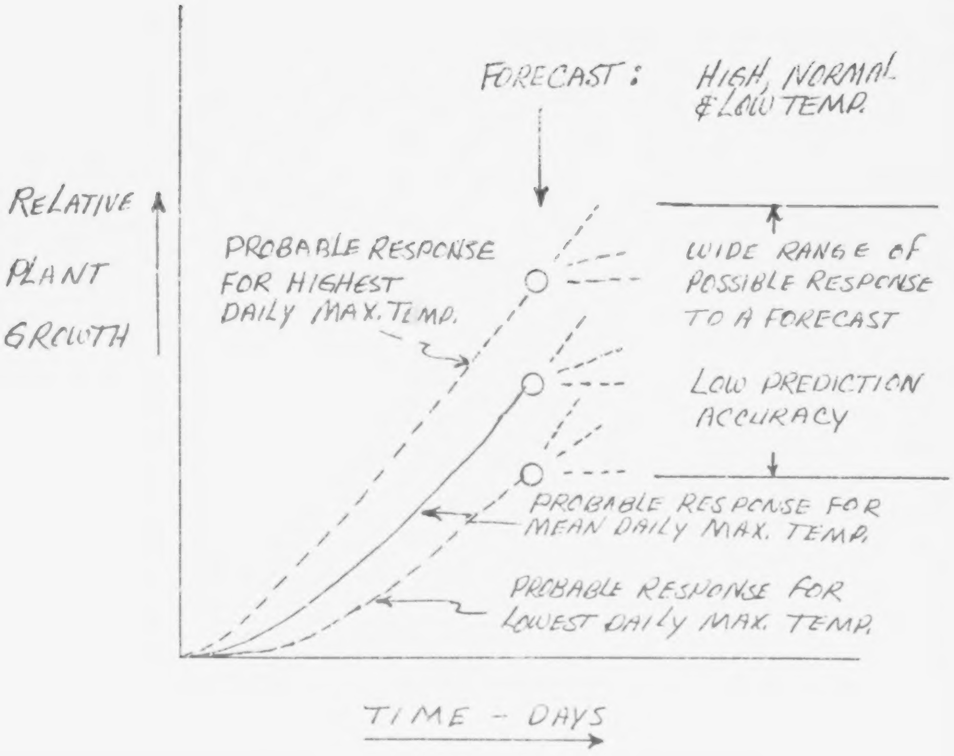

Figure 2:

Possible plant growth response to a range of seasonal maximum temperatures based on long term historical data.

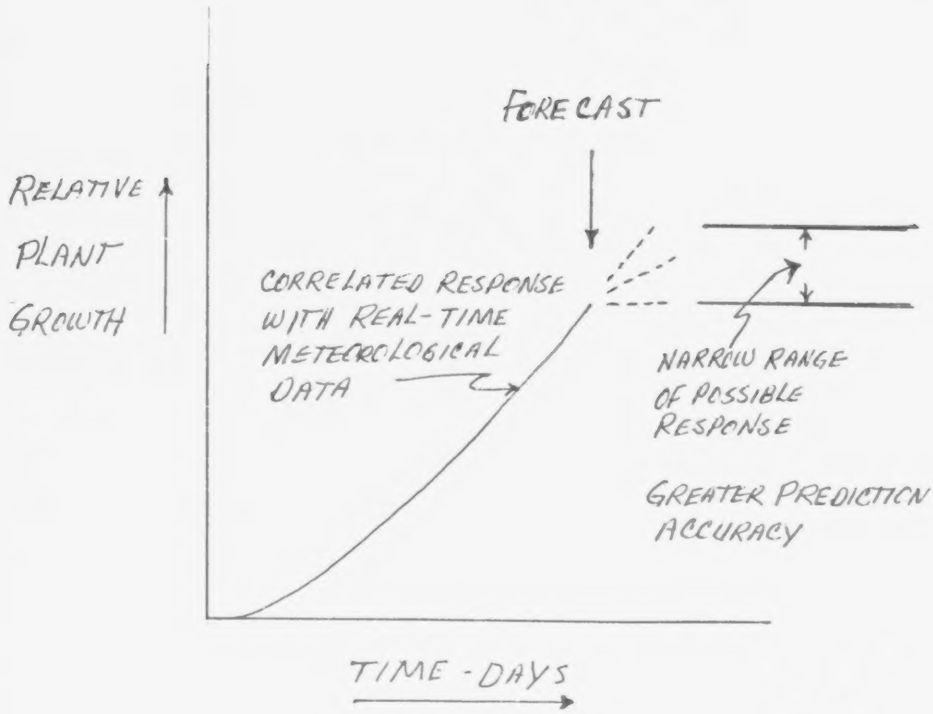

Figure 3:

Plant growth response based upon correlation with real-time temperature data .

Biographical Sketch

ROY S. RAUSCHKOLB
Director, Cooperative Extension
University of Arizona

EDUCATION:

B.A. Chemistry, 1961: Arizona State University--Tempe
M.S. Agricultural Chemistry and Soils, 1963: University of Arizona--Tucson
Ph.D. Agricultural Chemistry and Soils, 1968: University of Arizona--Tucson

POSITIONS HELD:

Soil Specialist, University of Arizona, 1967 - 1969
Soil Specialist, University of California--Davis, 1969 - 1977
Program and Regional Director, Cooperative Extension, University of California--Davis, 1977 - 1981
Director, Cooperative Extension, University of Arizona, 1981 - Present

CONSULTING:

Food and Agriculture Organization, Rome, Italy, 1972 and 1974
International Atomic Energy Agency, Aleppo, Syria, 1977
EPA (Intergovernmental Personnel Assignment), 1976
East Bay Municiple Utility District, Oakland, California, 1975
Development, Planning and Research Associates, Manhattan, Kansas, 1974 and 1976

Thank you for the opportunity to make these remarks.

Mr. **Brown**. Do you have a statement, Dr. Strommen?

Dr. **Strommen**. No, Mr. Chairman; I am primarily here to assist the Department.

Mr. **Brown**. Make sure they don't make any mistakes.

All right, Mr. Roberts, do you have any questions?

Mr. **Roberts**. Yes, Mr. Chairman. First I would like to thank all of the witnesses for their very fine statements and for taking their valuable time to come to the subcommittee and testify.

I've got a budget question, which is not strange in this town at this particular time. I note that in the fiscal year 1985 budget recommendations for the National Weather Services that the Agweather system, it was proposed that we reduce that budget by $1 million, which amounts to 33 positions, we reduce the fruit frost system area by $418,000, which would be a loss of 8 positions. It would reduce, according to the budget recommendation, the fire weather system to the tune of 25 positions or $808,000.

It is also my understanding that these amounts were restored by the House and probably will be restored by the Senate.

I would just like to ask you how you are doing under the circumstances, with these kinds of budget projections on your personnel morale, and where you are headed?

I would liken these restorations to several of the conservation areas, the Bay Plains Conservation Program, which is next to godliness and motherhood in my district, which always ends up with zero funding and we always restore it. The agriculture conservation program ends up with zero funding or less than last year, and we always restore it. That has been the case for four or five Presidents.

But it seems to me in terms of continuity and planning, that this would be a real difficulty. I apologize for the length of my question, but would you care to respond, Dr. Hallgren, or anybody on the panel?

Dr. **Hallgren**. Well, I will respond.

Generally it certainly hasn't made life easier, to say the least, but one of the things that we have been doing is relying on the dedication of those people out there providing the service. And it certainly makes it somewhat more difficult for them to realize that the very important activities that they undertake could be in jeopardy and their jobs could be in jeopardy.

But quite frankly, the people in the Weather Services have continued to do the very best job they could under these conditions, and that is about the long and short of it.

Mr. **Roberts**. I would like the record to show that there is strong bipartisan support for the restoration of these funds, and I would like for you to give that message to your people in terms of the dedication and effort that they are putting forth. And as far as I am concerned—and I won't speak for the Chairman; his leadership is very clear in that regard—but as far as I am concerned we will be leading an effort and that effort will be bipartisan.

I don't see really any difference in regard to the importance of this kind of effort between a comprehensive agricultural weather system and that of the aviation weather system and the Federal involvement in that area. And I don't know—well, I won't ask you what kind of cost estimate it would take to bring that up to snuff, but at least in my personal opinion I think you know where I am headed.

Let me ask you a parochial question. I have here a map of the great State of Kansas, and the National Weather Services radio in Kansas. We have seven of your stations in our State. I am privileged to represent the 58 counties west of the State here, or what we call Real Kansas, and we have 28 of the 58 who are simply not covered. If these were irrigation circles here in terms of the coverage here, why, we wouldn't get all of the crop in. And that is what I am worried about.

I'm just wondering—I don't think we want to go through the cost of erecting new stations, but what could we do? Why couldn't we increase the signal power so that these 28 counties could be served? And I am sure that there are other gaps in many other Members' districts who have a vital interest in agriculture. You don't need to be told that we are living in tornado alley, and we have violent storms out on the prairie, and we need this coverage. So how can our farmers in those 28 counties get your black box?

Dr. HALLGREN. Well, first of all, I am from the hills of Pennsylvania, and you have to be skilled up there to get a weather forecast, and that is one of the difficulties you have. It is very easy to get it in a metropolitan area, and it is very difficult to get it in a rural area. And we know that, and we have been trying to work very hard with another service that we have, the NOAA Weather Wire Service, to encourage as many radio stations and television stations to subscribe to that particular service as a way of getting more information into the rural areas.

With regard to your question on increasing the signal strength, that wouldn't do it, because this is operated at very high frequencies. It is basically line-of-sight, and it is limited by line-of-sight. Of course, that is one of the advantages, because it restricts the area that you are given the information through this radio system to, and therefore it is specifically related to that area. So that wouldn't be the answer.

We are also in a mobile band, and we are the highest powered station in that band. So we have to go to either more stations or to working other means of dissemination. And I personally think in the area of the dissemination of agricultural weather information that with the technology that is coming down the road now with on-demand systems, using very small computers and telephone ties, that we can see a lot of progress in the future in disseminating agricultural weather information through the joint efforts on a Federal, State, and private sectors' parts.

Mr. ROBERTS. As you can tell, I am a layman in this field, and pardon my ignorance in this. But are we saying to these folks in the 28 counties, then, that we are going to wait on future high tech, or should we be telling them that each county and local area might be able to purchase—what? A rebroadcasting kind of facility? Is that possible?

Dr. HALLGREN. There are places where we have put in another transmitter that rebroadcasts, and that same information that is on one of the other NOAA Weather Radios, that does come back to the installation, though, of additional facilities.

What I was saying is that that is obviously one way we can go. A second way is to try to make even more effective use of the media, radio stations——

Mr. ROBERTS. Well, let me interrupt you and say that I have 92 weekly newspapers, 18 dailies, and 42 radio stations in my district. Forty-two radio stations and nine TV outlets, and they do an outstanding job. As the chairman of the full committee said yesterday, if the weather is not given by your local weatherman, well, they don't believe it, regardless of what the computer says. And they do an excellent job, so I know it is a partnership in this regard.

But that black box that our farmers have used to be thought of sort of as a convenience or, I will even say, a toy, until we became aware of what the full implementation of the Nebraska system has meant to their producers. It is no longer a toy, I can assure you. It is a vital piece of information that our farmers think they should have.

Let me ask that about—is there somebody on the panel that could explain to me how the Nebraska system was originally funded when first underway and compared to what it is funded now?

I think, Dr. Clegg, you mentioned that in terms of the AGNET network.

Dr. CLEGG. Of course, the AGNET system, you know, a computerized system, was put together I believe as a joint commission. This is my home State, by the way. I used to chase coyotes into Kansas out of Dundee County, so I know your area well.

Mr. ROBERTS. Send us a few linebackers, we need those.

Dr. CLEGG. But there has been a concerted effort there at the university level in cooperation with State government, as well as with NOAA and special grants from the National Climate Program Office. It has been a high priority, so they just continue to put emphasis in it.

Mr. ROBERTS. And when you say "they," you mean the Nebraska State Legislature?

Dr. CLEGG. The legislature as well as the university system, yes.

Mr. ROBERTS. And how does that compare with the funding today? Is it still primarily funded on that basis?

Dr. CLEGG. Well, there is a person in the audience who might like to comment on this. He was just out there recently.

Mr. ROBERTS. I can probably talk to him personally. I don't think we should take the subcommittees' time for all of that.

Well, gentlemen, thank you very much.

Dr. CLEGG. But you would like some information on the Nebraska system?

Mr. ROBERTS. Yes, I would.

Dr. CLEGG. We will provide that for you.

Mr. ROBERTS. I can probably talk to Virginia Smith, and she can give me an earful.

I appreciate your testimony. Thank you, gentlemen.

Mr. BROWN. Gentlemen, we have sort of a generic problem in this area. What we really want to do, of course, is to utilize to the fullest available technology to provide the services that agriculture needs. In the process, we want to involve the private sector as much as possible. In the process, we also want to put the maximum responsibility at the state and local levels. These are just fundamental principles that I think everyone in the Congress, at least, is guided by at this point.

Now, there are a lot of ways of going about that, and we are dealing with these. For example, Dr. Hallgren, as you well know, we have considered whether to privatize all of the weather system, including the basic satellites. We are commercializing LandSat, or we are considering legislation to commercialize LandSat. We have passed legislation to commercialize expendable launch vehicles. A number of things that are going on in the high technology area, the Congress wants to involve the private sector as the dynamo to disseminate these services as effectively as possible.

I know of no substantial disagreement, but there is a question about how and on what schedule you do it. It is like teaching a baby how to swim. You can either help the baby learn to swim, or you can just throw it in the pool and say "swim or drown." And too much of what we seem to be seeing today in agricultural weather service may be a case where we are saying "cut off the money and it will survive or drown." And the Congress is not happy with that particular kind of approach, which brings me to the question of the need to do some transitional planning here.

Regardless of what the ultimate scheme is, somebody has to conceptualize it and then somebody has to plan to achieve that concept, assuming that it has been agreed to by all of the actors.

Now, I note, Dr. Hallgren, that you say there is a working group to update the Federal plan for agricultural weather service. Apparently that is somewhat in a hiatus, or am I mistaken in this? Do we have a finished plan for the Agricultural Weather Service, for whatever scope we want it to have, and for whatever transitions we want it to make to private involvement? Or are we still trying to find our way in this area?

Dr. **Hallgren**. Well, it certainly has been an unsettled period in terms of planning in this particular area. The plans—as you know, we had plans in the 1970's, that we—initial ones that we carried out. Others we never did get completed. And in the late 1970's and in the very early 1980's we were developing the more comprehensive plan for agricultural weather services across the country jointly with the Department of Agriculture, and in association with the many groups that provide valuable inputs from the state level and from consortium types of arrangements.

These plans are still in draft stages, and what they principally involve is trying to get the Agricultural Weather Service centers instituted across the whole country.

At the same time, as I indicated in my testimony——

Mr. **Brown**. Let me interrupt you at that point. Are these the centers that were referred to in yesterday's testimony that we have four of them now around the country?

Dr. **Hallgren**. Yes.

Mr. **Brown**. Originally it was planned to develop——

Dr. **Hallgren**. About a dozen.

Mr. **Brown** [continuing]. About a dozen, but we never fully implemented that; OK.

Now, I am going to ask you to provide the committee with at least the main planning activities that you have done over this period that you have just described, so I can see a little bit of what you had in mind and what happened to it.

But proceed with your testimony.

Dr. HALLGREN. Then, in the last year or so, as I indicated in my testimony, we have been engaging with the private sector across the country, and I named the places where we had conferences, to try and come—get a better insight as to what is the most effective way of blending the Federal activity and the private sector activity to provide the service. And very much in my mind throughout this has always been to ensure that whatever we do, there is a continuity of service and in general the service is being enhanced to the farmers.

Of course, our experience, if I may go just a bit more generally, Mr. Chairman, this isn't the only area in which we are trying to work with a blend of Federal and private services. And in each and every case, we don't find a magical solution, you know, that we can say that this is this compartment and this is this compartment, this is another compartment. What happens is that it is an evolving thing and if you stay in close touch and close harmony—and I believe we are—and I have talked to enough of the private people as well, we are in pretty close harmony and working toward a gradual, evolutionary type of arrangement.

I think through that type of a mechanism we will have the best chance of not having a break in the continuity of the service. It is certainly our intent in the next couple of years to continue those dialogs, and try and get so that the boundary conditions are a little bit more defined and not as general as they are today.

But overall, in all of our experiences, whenever the private sector can get specific clients to serve they do it very well, and it also makes for an appropriate business relationship. But they will always be, of course, relying upon all of the data and products that we put out from the Weather Service. It is a big country, and it is a complex country weatherwise.

Mr. BROWN. Well, I have no fundamental fault with what you are describing, except to this extent. To the degree that you are not able to crystallize some reasonable path of development, you discourage the private sector from making investments in this area. They don't know what their future is likely to be. People are notoriously reluctant to put money into situations of that sort.

Now, we know that—and you know, or you have expressed—that this is a rapidly evolving technological field. But we are not trying to project the technology development as much as we are trying to project a framework within which we can accommodate ourselves to that technology development. We will never be able to gel that so that it is stable and there is no more change in the technology. Modular telephones, low-power television and radio are currently modifying the circumstances under which we can disseminate a lot of this weather data. And we also have some hope that the basic science itself is providing new opportunities for change.

Which brings me to the question of the National Climate Program Act, which you referred to, Dr. Rauschkolb. Refresh my memory as to how that relates to the climbing process that we are engaged in here for the agricultural weather. I have a vague recollection that that Act contemplates not only fundamental meteorological research and improving the coordination of that, but how the products of that research can be more effectively made available to the user community. Am I mistaken in that?

Dr. RAUSCHKOLB. Are you referring the question to me?

Mr. BROWN. I am referring it to whomever has the best answer.

Dr. RAUSCHKOLB. Well, I am not sure I can answer a question about the National Climate——

Mr. BROWN. You have had some experience with trying to get funding, and apparently you didn't succeed.

Dr. RAUSCHKOLB. Yes; that was the problem.

Mr. BROWN. And Dr. Hallgren is not part of the National Climate Program Office, I guess. But at least you work in the same department with it. Maybe you have some information on it.

Dr. STROMMEN. Mr. Chairman, may I address that?

I do work with the National Climate Program as one of the representatives of the Department of Agriculture, and you are correct, that is one of the goals of the National Climate Program.

Mr. BROWN. It is one of the goals, but it is not being implemented. Is that it?

Dr. STROMMEN. There are pilot projects that are attempting to demonstrate how it may be implemented, including the Nebraska network. They have been successful to a degree, but only limited to selected projects.

Dr. CLEGG. I might add, in terms of coordination, this October there is a conference in Kansas City where the research community will be getting together on our regional research projects, and planning ahead. This is a national meeting, five or six regional research projects, representatives from the National Climate Program Office, Extension, the private sector, ARI, will be interacting with that group. We see this as a real opportunity to focus in the area that you mentioned in terms of the new products and new direction.

Dr. RAUSCHKOLB. I might just make a remark relative to one of your comments about the need for some planning to really address the application of this weather information in private industry. One of the things that I think leads to that as part of the natural evolutionary process is an education of the potential user and providing a potential user with the mechanism to utilize that information. And that is the thing that I think is missing.

I am not interested in capitalizing in that work that private industry can come in and support. By the same token, I don't think private industry is going to come in and try and develop a demand unless a demand can already be identified. And that is one of the things that I think is important, particularly in the Arizona program and, I think, has also been demonstrated in California.

Unless somebody begins to show these relationships and begins to educate the user on the application of this information, private industry doesn't have any demand out there that justifies building a system. So all these things, then, come together in that regard. You need to have a national network. You need to have an intrastate committee or a system, and an education and development program for these predictive and decision-aid models. Once we have that in place, then the natural evolution is for private industry to come in and take over. But they are not going to do it initially.

Otherwise they would have done it already in Arizona. But that is why we started our system.

Mr. Brown. Dr. Hallgren, you have made reference to the Agricultural Research Institute's proposed Agricultural Weather System plan. And I have no objections, if the Weather Service isn't going to be able to do a planning job, to have some outside group do it.

You make the statement that you want to assure a smooth transition to the national or regional weather information system of the future, and that you will be glad to participate in and provide support to good, cooperative arrangements. And I commend you for that statement, but I expect more, actually. I expect you to provide some leadership in doing this. And I think this is where we are running up against a roadblock. Nobody wants to take the leadership because of the ambiguous nature of the situation, and also because there is a certain feeling that it may be looked upon as aggrandizement, as trying to expand our empire, or maybe because just the very concept of planning is not in good favor.

We have got to overcome that, because really what we are doing here—and this is very catchy these days, politically speaking—we are trying to improve the productivity of this country. And there is no question in my mind, and every witness has testified to it, that we have the opportunity to improve the productivity of agriculture to the tune of several billions of dollars per year. And that is worth devoting a little leadership to, it seems.

I will defer now to Mr. Olin for any questions.

Mr. Olin. No questions, Mr. Chairman.

Mr. Brown. Do you want to make a comment? preach a sermon?

Mr. Olin. No thank you, Mr. Chairman.

Mr. Roberts. Mr. Chairman, may I ask several other lay questions?

That was my original intent in asking the question of who first funded the Nebraska program, because it seems to me that the State of Nebraska is a real leader in this field. And I can't say it exactly like the chairman has said it, but it seems to me—oh, for instance, in Dodge City, we have a private firm that does an outstanding job being of service to producers to tell them where the soil moisture is, what the soil moisture situation is, how much fertilizer to apply, et cetera. It is called Servtech. I will give it a plug. If you want to know how the wheat harvest is coming, you ask Raleigh down at Servtech, and he will tell you.

Now they don't have people going out in the field so much as they have sensors and computers, and so on and so forth.

There is another outstanding organization in Dodge City called the High Plains Advertising Co., which has the High Plains Journal, and it produces a lot of information. And they have always wanted to go to a kind of software sales package to get our producers on a level with, say, what is happening up in Nebraska. But they are not really quite ready to make that kind of an investment.

That, I guess, is what I am looking for. Ten years ago, as I said, the black box sitting out there in his garage or wherever it was, in the ranchhouse, was viewed as sort of a toy. Now it is not. And in Nebraska, unless I don't understand what is going on here, you can tie that black box with the National Weather Services repeated broadcasts, and get it computerized from the university extension office, and any day you can find out the soil moisture in your field, or what kind of fertilizer application to put on the field, et cetera. That is the kind of high tech explosion, on-hands, a practical approach that we are looking for.

I just wish that this kind of information to the user and the benefits to the producer could be made available to virtually every State that is involved in this. I have been sort of a pest down at Kansas State University trying to get them on speed here. And I guess my concern is like the chairman's—which comes first, the chicken or the egg?

They are not going to make that kind of an investment, if you please, unless they see a commitment and an ongoing commitment from the Federal level. Which is why, I think, all of us here are committed to the proper kind of funding of this effort.

I guess I made a statement rather than a question. Would any of you care to comment?

We had an Ag network here during Ag research hearings several weeks ago. And the main problem, according to the Maryland Extension witness, was the lack of availability of the software package. He only had 44. But he anticipated, as this information became more beneficial to the farmer, that it would go up by leaps and bounds. Well, who is going to make that investment? I guess that is my point.

Do you have any comments there?

Dr. **Rauschkolb**. Well, I might just make a comment, Congressman Roberts. I think in Arizona, for example, the university and the State legislature is committed to making that kind of investment, recognizing that there is a technology available for the delivery of this information as well as collection of considerably more data which allows us to be more sophisticated in the kind of predictions that we can make.

One of the points I was trying to allude to earlier in my testimony was when we are dealing with historical means for 10-year or 20-year periods, and trying to calculate biological system response to those, we are not very successful, and therefore our forecast or predictive ability is very much limited. If we can come in with a real-time, much more sophisticated weather data collection, or meteorological data collection system, then we can spend some money in the development of models which people will use.

The problem is, if you develop a model that is built on inaccurate data and you make a prediction and it is inaccurate, then what good is it? Nobody wants to use it. So it really is a whole system.

I quite agree that there needs to be some transitional planning. There needs to be a different attitude about the quality and the type of weather or climatological data we collect; how that is disseminated and how it is used.

I think in my opening statement I said that we are on the verge of a technological advance. The technology is here, but it is the application of it that isn't here yet.

Mr. **Roberts**. Well, we are in the business, of course, of asking questions and not really coming up with any answers. And you gentlemen have done that this morning. I really appreciate that.

Thank you, Mr. Chairman, for yielding this time.

Mr. Brown. Dr. Rauschkolb, in Arizona you have an automated data collection system which, as I understand your presentation, you use satellites to collect the data and then focus it at a central processing point, and you do the processing and computer work.

Dr. Rauschkolb. We are just in the process—we just got funding that will be effective July 1 of this year. So we don't have our system in place yet. We would have loved to have used satellite as a mechanism for transmitting the data. But we are going to have to get automated stations that are hard wired to telephones so that we can collect the data on our computers.

So that limits us in our ability to place these. If we had a satellite that were available, then we could transmit the data from these automated weather stations to the satellite, then back transmit to our computer and centralize the data, and be a lot——

Mr. Brown. You explored the satellite linkage and found that it was not available?

Dr. Rauschkolb. It wasn't available, and while it was too expensive in that sense, it wasn't available.

Mr. Brown. Well, that is a subject that we ought to explore, because satellites, of course, are distance insensitive. We could have a network covering the entire United States with central or regional or decentralized processing of the weather data.

In the face of your statement that it is too expensive, we have the fact that there is about—if I recall the figures correctly—about a 25 percent excess capacity in satellites, and it is expected to continue for several years, basically because they put up satellites at expectation of the load they will be carrying down the road and they haven't reached that yet.

So it would seem reasonable to me that we ought to at least provide a little bit of that excess capacity at some sort of a favorable rate, even if it is on a short-term basis of 2 or 3 or 4 years, in order to see how valuable such a system would be.

Dr. Rauschkolb. I could do nothing but applaud that. Some of our areas, as you well know, and it is similar in northern California, are pretty remote. But they are still important agricultural production areas. So we need to have weather stations located there where we can collect that data and feed it into the system.

Mr. Brown. All right, Dr. Hallgren, can you provide the committee with the background information on the Federal Plan for Agricultural Weather Services' current status, and some of the prior activities that will help us to understand where we stand on that?

Dr. Hallgren. Yes; I will.

Mr. Brown. And those conferences that you referred to that you conducted around the country, did you issue any reports or findings or summarize the——

Dr. Hallgren. Yes; we have summarized them. We also have the material that we presented there.

Mr. Brown. Would you provide this committee with a summary of your results in that regard?

Dr. Hallgren. Yes.

Mr. Brown. We would appreciate that very much.

Thank you all very much, gentlemen.

Dr. Hallgren. Thank you, Mr. Chairman.

[Material to be supplied follows:]

W/OM14x1:PDL
AUGUST 8, 1984

SUMMARY:

NOAA CONFERENCES FOR THE PRIVATE SECTOR ON AGRICULTURAL AND FIRE WEATHER SERVICES

Last fall the National Oceanic and Atmospheric Administration (NOAA) held four conferences for the private sector. Every firm listed in the Professional Directory of the American Meteorological Society's Bulletin (total of 91 firms) was invited.

The first conference was held in Kansas City, MO, on September 27, 1983. We described the National Weather Service's (NWS's) agricultural weather, fruit frost, and fire weather programs; National Environmental Satellite, Data, and Information Service's products and services; and the Family of Services dissemination system. This conference was an overview, and was attended by representatives of the following 6 firms: Oceanroutes, Global Weather Services, Global Weather Dynamics, Nowcasting, Control Data Corp., and Metro Monitoring Services. The major interest of this group was data availability: how to get our products, what new products are planned, need for uniform product and header formats, and quality control of data. The issue of Federal versus private roles was not a significant part of the discussions. Instead, the concensus was that the firms were comfortable with our current relationship. One firm stated that the really successful meteorological firms are the ones that offer their clients the NWS products virtually verbatim.

The second conference covered the fruit frost services and products specifically, and took place in Tampa, FL, October 13, 1983. Only one firm attended (Gulf Coast Weather, of Tampa). Data access and communications problems were the major topics of discussion, centering on the Family of Services system.

We held the third conference in Salt Lake City, UT, on October 18, 1983, covering the fire weather services and products for one private participant (North American Weather Consultants). Data access topics again dominated discussion, and the participant allowed that there was no apparent role for private meteorological firms in providing fire weather services in the West - that mobile unit support and spot forecasting is necessary and cost-effective as a Government service.

The final conference covered the agricultural weather program services and products, in Lafayette, IN, on October 20, 1983. Two firms attended: Global Weather Dynamics and James Newman, consultant. Again, data acquisition topics dominated the discussions. However, while these participants also felt the NWS role is correct and should continue, they also noted they need to know a final position: is NWS in, or out of the agricultural weather business?

The NWS is working to resolve the problems linked to the new Family of Services. A Family of Services user coordination board has been established that should help NWS to be responsive to requests by reviewing and prioritizing them before they are submitted.

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DRAFT
March 1982

NATIONAL PLAN FOR
AGRICULTURAL WEATHER SERVICES

For review and discussion purposes only.

FOREWORD

The goal of this National Plan for Agricultural Weather Services is to provide the Nation's agricultural producers with the weather information and weather-related recommendations they need to maximize production efficiency through weatherwise planning and decisionmaking. The Plan responds to the Office of Management and Budget Circular A-62 and is directed toward a more effective Federal-State partnership in field agricultural weather services during the 1980's. It makes maximum use of the observational networks and the data-processing and dissemination facilities of the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA) and the Department of Agriculture. The Plan includes supporting agricultural weather observations, research, communications, and training.

Plan implementation is discussed in general terms. Details regarding costs and agency tasks are included in the appendix.

Federal Coordinator for Meteorological
Services and Supporting Research

1. INTRODUCTION

Weather controls the development of the many biological systems that constitute American agriculture -- the germination of seeds, the hatching of insect eggs, the germination of spores, growth and development of weeds and crops, and finally the quality and quantity of crop and animal production. Application of weather-based information to production decisions can greatly improve production efficiency.

There is little that man can do to protect his crops against catastrophic extremes of weather -- floods, tornadoes, hail, or massif freezes -- but he can optimize his production practices if he considers variations in weather conditions.

This National Plan for Agricultural Weather Services outlines a plan to provide the Nation's farmers with the weather-based information he needs to make day-to-day production decisions that will contribute to the most efficient production under prevailing conditions. This program will provide the information needed for cost-effective decisionmaking on the farm. This plan also provides for the establishment of a career ladder in agricultural meteorology that is essential if qualified personnel are to be recruited.

This plan recognizes the need to meet four requirements that working together will enable farmers to maximize their operations under existing conditions. These requirements are as follows:

1. Establishment and maintenance of a high density rural weather observation network to allow forecasters to fine-tune their

forecasts, and also provide localized weather inputs to Extension Service computer models of biological development such as in the Integrated Pest Management (IPM) program. These networks also provide data for analysis of weather impacts at important climatic divisions at State and substate levels.

2. Development of weather-based agricultural recommendations for farmers that will help them maximize their farming operations.

3. Dissemination of these recommendations and advisories to farmers using all available means.

4. An educational program to teach farmers how to apply the information to their day-to-day production decisions.

At this time, no place in the Nation has adequate agricultural weather services although each part of this program has been proven. This program is directed toward providing all segments of agriculture with the types of weather-based information needed to maintain a viable, cost effective, and competitive industry.

This plan recognizes the need for localized weather-related services and effective communications by placing the focal point for such an effort within the Extension Service of each Land Grant University.

2. SERVICE CHARACTERISTICS AND USER EQUIPMENTS

The Agricultural Weather Service Program depends on the existence of a meteorological program to provide measurements, analysis and predictions of atmosphere variables (e.g., temperature, precipitation) on a scale significant to agriculture's needs, and the interpretation of these variables for development of weather-based agricultural recommendations for farmers.

These variables must then serve as a basis for development of recommendations to assist farmers in making day-to-day production decisions.

The information for the agricultural community must satisfy certain fundamental criteria:

* accurate within the limitations imposed by the current state of the art;

* timely and issued when required;

* applicable in terms of both content and format;

* available at those locations where the user needs the information for making operational decisions.

a. Measurements

The meteorological program will need observations on an agriculturally significant scale to supplement data received from basic networks. Information from all observation programs must then be transformed into the weather variables needed by the agricultural community and must be consistent across States to permit production area analysis.

[illegible]

Additional observational sites added on a current basis to the National Weather Service's basic observing networks, will provide valuable supplemental data, aid in the preparation and verification of forecasts and advisories and in the evaluation of existing techniques, and provide real-time data for input into such weather-dependent activities as integrated pest management and irrigation scheduling.

b. Climatic information

Given an adequate data base, an agricultural weather service can make its initial contribution toward planning agricultural activity through the introduction of appropriate climatological information. The farm operator needs the probability of when, for how long a period, or how frequently will weather conditions be favorable or unfavorable for a particular activity. Climatological data supplemented by 6-10 day, 30-day, and seasonal weather outlooks represent the main information sources for the planning phase.

c. Weather forecasts

In executing daily or weekly operations, weather forecasts become one of the key factors in the farmer's decision process. At present, weather forecasts are superior to predictions from climatic data for periods of up to 3 days under most conditions. In certain situations and with certain parameters, such forecasts may remain usable up to 5 days. For maximum utility, the weather forecasts must be presented in a form compatible with the user's operational decision process, and must include consideration of the ongoing agricultural activity.

d. Dissemination

The dominant factors that must be considered in dissemination of agricultural weather information are quality of the information, timeliness, ease of accessibility, and costs. Therefore, all available methods of dissemination will be used depending on the types of information to be handled. Included will be commercial and public radio and television, NOAA Weather Radio, teletypewriter circuits, telephone and computer networks. Videotex systems now being installed will significantly improve the ability to provide detailed agricultural weather information directly to farmers and ranchers.

3. BENEFITS

Agriculture is experiencing rapidly rising prices for the various inputs that make up a large part of the cost of production: energy, chemicals, water, and machinery. These economic conditions are expected to continue into the foreseeable future. Hence, the making of better plans and decisions for the efficient and cost-effective use of these resources becomes of paramount importance in controlling food prices and maintaining proper levels of farm income. The use of specific agricultural weather information increases production efficiency and reduces risks associated with weather-influenced operations such as the application of water and fertilizer, controlling pests, and scheduling labor. For example, research shows that weather information applied to ongoing Extension programs can result in a reduction of pesticide needs of 20 percent, reduce herbicide needs by as much as 25 percent, and reduce irrigation water and energy needs by more than 30 percent.

4. ROLES OF THE AGENCIES AND RELATIONSHIPS

The Federal government incurs specific responsibilities through the various laws and regulations promulgated to manage the Nation's agriculture programs. The Department of Agriculture is charged with providing the majority of Federal services to agriculture including information concerning those factors influencing agricultural production and to provide, through educational programs, knowledge to utilize production information. This should inlcude data and information service to help farmers make optimum use of agricultural weather information.

The Department of Commerce, through its NOAA, is responsible for basic weather services; specific weather services for the benefit of agriculture, commerce, and other sectors; climatic data and information services; and research and development in the foregoing fields of activity.

A partnership between meteorologists, Extension specialists, and agricultural research scientists is essential to improve agricultural weather services for producers of agricultural commodities and supporting services. This multi-disciplinary effort can bring a wide range of expertise to bear on highly complex problems.

5. PLANS FOR IMPROVING THE NATION'S AGRICULTURAL WEATHER SERVICE GOALS AND OBJECTIVES

The goal stated in the Foreword to this Plan will be approached through complementary efforts of the cooperating agencies.

This plan for a more effective agricultural weather service is based on a joint effort by NOAA (NWS, NESDIS), USDA (ES, USFS, CSRS, ARS), and the States (Extension Services, experiment stations). The NOAA units will focus resources on developing and refining their weather information capabilities; USDA and the state agencies will concentrate on development and application of weather-based agricultural information. The information from all sources will be disseminated to the agricultural community by all means available.

6. PROGRAM PLAN

a. Weather Information (NOAA)

Observation networks will be upgraded to provide nationwide measurements of such elements as soil temperature and dew duration that are now available in only a few areas. Automated forecast guidance will be developed to pinpoint the weather elements that are important to current agricultural activities. The National Weather Service will issue specific agricultural weather forecasts and general advisories based on the public zone forecasts from the WSFO's in their region. The observed and forecast agricultural weather data for each area will be merged with the basic NWS observations and forecasts into an automated database. These products and services will be provided to the agricultural industry.

b. Agricultural Information (USDA and State Agencies)

The Extension Service of USDA, with the State Cooperative Extension Services and NWS, will establish an agricultural weather program to provide farmers and others in the agribusiness community with weather-based agricultural information and an educational program that will teach its clientele how to make maximum use of this information in making day-to-day production and marketing decisions.

7. IMPLEMENTATION OF THE PLAN

The NOAA will be responsible for gathering meteorological data and development of the necessary weather information. The Cooperative Extension Service will be responsible for development of weather-based recommendations to the agricultural community. Both agencies will take an active role in dissemination of all information.

The Extension Service of USDA, working with the State's Extension Services that comprise the Cooperative Extension Service, will establish an Agricultural Weather Center in each State. This center will work closely with appropriate NWS offices, Extension and Research staffs in developing weather-based recommendations for farmers and ranchers.

To improve the quality of observations from rural areas, Extension will establish or expand and maintain the rural volunteer weather observation networks. This information will be available to NWS and the University staff to fine-tune programs and forecasts.

Extension will apply the meteorological information to a wide range of ongoing programs such as IPM, irrigation scheduling, and weed control to greatly improve the efficiency of these efforts.

Research programs conducted by Agricultural Research Service and the State Agricultural Experiment Stations will focus on problems of weather impacts on crops, livestock, and the water and soil resources of the Nation. The goal of the Department of Agriculture's supporting research and development is to provide methods whereby the farmer can utilize pertinent information to determine the most effective course of action to minimize cost, increase efficiency, and reduce losses.

The principal research areas are: (1) integrated pest management, where the combined influences of weather and specific pest life cycles are inputs to pesticide choice and application decisions; (2) weather - crop yield modeling in which the environmental influences - including weather - are used to simulate crop development and yield; (3) water and soil moisture management, including the development of improved methods for calculating the soil moisture profile and the research and technical support for irrigation scheduling for various field crops; (4) research on environmental factors affecting livestock production to identify relationships between weather factors and the growth, development and general health of livestock and poultry - criteria important for optimum management and shelter under a variety of climate and weather conditions.

NWS

DRAFT
MARCH 1981

NATIONAL PLAN FOR AGRICULTURAL WEATHER SERVICES

For review and discussion purposes only.
Does not reflect a coordinated position
of USDA or individual agencies.

This draft is based on USDA draft of
February 1981, and earlier USDA/USDC efforts.

Foreword

The goal of this National Plan for Agricultural Weather Services is to provide the Nation's agricultural producers with the weather information and weather-related recommendations they need to maximize production efficiency through weatherise planning and decision-making. The Plan responds to Office of Management and Budget Circular A-62 and is directed toward a more effective Federal-State partnership in field agricultural weather services during the 1980's. It makes maximum use of the observational networks and the data-processing and dissemination facilities of the Department of Commerce/National Oceanic and Atmospheric Administration (NOAA) and the Department of Agriculture. The Plan includes supporting agricultural weather observations, research, and training. It does not include service to U.S. Department of Agriculture headquarters; nor does it include specific fire weather or soil conservation weather services.

Plan implementation is discussed in general terms. Details regarding costs and specific tasks are to be updated and published annually in the Federal Plan for Meteorological Service and Supporting Research.

Thomas B. Owen
Federal Coordinator for
Meteorological Services
and Supporting Research

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   a. Department of Commerce
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5. Present Program

6. Plans for Improving the Nation's Agricultural Weather Service
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1. INTRODUCTION

This Plan addresses the needs of the entire agricultural community: the agricultural producers, i.e. farmers, ranchers, and growers; support businesses, i.e., firms engaged in providing supplies and services to producers, in transporting products, and in processing and selling agricultural commodities and finished products; and finally, extension staffs and other key State and Federal agencies that support agricultural producers; and public information media.

This Plan covers all aspects of agricultural weather services: measurements and observations; analysis, forecasts, warnings, and recommendations; climatic information; and supporting research and education. In addition the plan identifies roles, responsibilities, and relationships of the Federal government, the States, and the private sector.

2. SERVICE CHARACTERISTICS AND USER REQUIREMENTS

The Agricultural Weather Service Program, like all other weather service programs, depends on the existence of a basic meteorological program to supply measurements, analyses, and predictions of the physical state of the atmosphere. In addition, supplementary observation networks are necessary to provide meteorological information on an agriculturally significant scale. The information from these basic and supplementary programs must then be transformed into the needed weather variables and operational information that can be disseminated to and used by the agricultural community.

The operation of an information system that addresses the needs of the agricultural community must satisfy certain fundamental criteria:

- the information must be accurate within the limitations imposed by the current state of the art;
- it must be timely and issued when required;
- the information must be applicable in terms of both content and format;
- the information must be accessible, which means that it must be available at those locations where the user needs the information for operations.

a. Measurements

Essential to the Agricultural Weather Service Program is an adequate network of meteorological observations to provide real-time data on elements that characterize the physical environment of the agricultural area. As far as practicable, systems should be used that already are integral parts of the national aviation, synoptic, climatological and hydrological networks. Frequently, supplementary data, vital to the quality of the meteorological service provided, is needed. When this occurs, additional observational sites should be established or present sites upgraded for the specific purpose of supporting the Agricultural Weather Service Program. Normally, daily measurements should include maximum/minimum and current air temperature, precipitation (rainfall equivalent), intensity of rainfall, and where feasible, soil moisture, soil temperature, evaporation, humidity, dew duration, snow depth, and total radiation. The observations from the additional observational sites, if added on a current basis to the National Weather Service's basic observing networks, could provide valuable supplemental data, aid in the preparation and verification of forecasts and advisories and in the evaluation of existing techniques, and provide real-time data for input into such weather-dependent activities as integrated past management. Observations from additional stations also provide valuable data for supporting agricultural meteorology studies and for developing improved forecasting techniques.

b. Climatic Information

Given an adequate data base, an agricultural weather service can make its initial contribution at the planning stage of the agricultural activity through the introduction of appropriate climatological summaries. For intitial planning, the farm operator needs answers to questions of when, for how long a period, or how frequently will weather conditions be favorable or unfavorable for a particular activity. A second step in planning the operation is to devise a set of alternatives for dealing with adverse weather conditions that may be expected to occur, and to evaluate the capability of the service to warn in advance of the onset of unfavorable weather conditions. Climatological data supplemented by 6-10 day, 30-day and seasonal weather outlooks represent the main information sources for the planning phase.

c. Predictions

In executing daily or weekly operations, weather forecasts become one of the key factors in the farmer's decision process. At present, weather forecasts are superior to other sources of weather data for periods of up to 3 days under most conditions. In certain situations and with certain parameters, such forecasts may remain usable up to 5 days. For maximum utility the weather forecasts must be presented in a form compatible with the user's operational decision process, and must include consideration of the ongoing agriculture activity.

d. Dissemination

The information needed by the user must be available at the required times and locations. The criteria governing its dissemination must include timeliness and ease of accessibility. Timeliness of the dissemination must be such that neither the accuracy nor the applicability of the information is degraded through delays in communicating the information. The dominant factors in accessibility are cost and convenience: the cost of gaining access to the information cannot exceed the perceived net value of the information, and the effort required to gain access should not discourage its use.

Under these criteria, several dissemination systems have come into use, ranging from satellite communications to computer terminals, teletypewriters, telephone, NOAA Weather Radio, commercial and public radio and television, or combinations of these. It appears that commercial radio and television media will continue to provide a significant link to the ultimate user of the information. Several innovative systems under development, such as teletext, will significantly improve the utility for communication of agricultural weather information directly to farmers and ranchers. These improvements in dissemination will be further aided by the upgrading of NOAA's basic weather communication system linking all forecast offices with computer-oriented highspeed data lines.

3. BENEFITS

Agriculture is experiencing rapidly rising prices for the various inputs that make up a large part of the cost of production: energy, chemicals, water and machinery. These economic conditions are expected to continue into the foreseeable future. Hence, the making of better plans and decisions for the use of these resources becomes of paramount importance in controlling food prices and maintaining proper levels of farm income. The use of specific agricultural weather information increases production efficiency and reduces risks associated with weather-influenced operations--application of water and fertilizer, controlling pests, scheduling labor, and so on.

4. ROLES OF THE AGENCIES AND RELATIONSHIPS

The Federal government incurs specific responsibilities through the various laws and regulations promulgated to manage the Nation's agriculture programs. The Department of Agriculture is charged with providing the majority of Federal services to agriculture, including research to provide the basis for development and enhancement of an operational weather activity and service and education to farmers, ranchers, and supporting businesses. An important function is education to help farmers make optimum use of agricultural weather information.

The Department of Commerce, through its National Oceanic and Atmospheric Administration (NOAA), is responsible for basic weather services (e.g. weather forecasts); specific weather services for the benefit of agriculture, commerce and other sectors; climate data and information services; and research and development in the foregoing fields of activity.

A partnership between meteorologists, extension specialists, and agricultural research scientists is essential in order to improve agricultural weather services for producers of agricultural commodities and supporting services. This multi-disciplinary effort can bring a wide range of expertise to bear on highly complex problems.

5. PRESENT PROGRAM

The Agricultural Weather Service Program is a collection of services that have been established to provide meteorological support to farmers, ranchers, and growers.

These services evolved over many years, as Federal, State, and County agencies attempted to respond to the highly divergent needs of agriculture. The resulting service may be quite general, consisting of weather-related agrarian advice in extension newsletters. Or it may be a specifically tailored menu of weather observations, forecasts, and time-critical advisories to farmers. This level of effort involves coordinated actions by a number of agencies, e.g., the programs in Indiana, California and Mississippi.

This type of agricultural weather service, where it exists, has a direct and positive influence on food and fiber production. It reflects a response to a concerted demand for a special government service by local farmers and farm organizations. As agriculture has become more sophisticated, farmers throughout the Nation have perceived the intrinsic values of precise tailored weather intelligence to their operations. Thus the vocalized demand for such services has now become widespread, and it is clear that a plan of action is necessary to carry out this charter.

USDA/State and County Programs

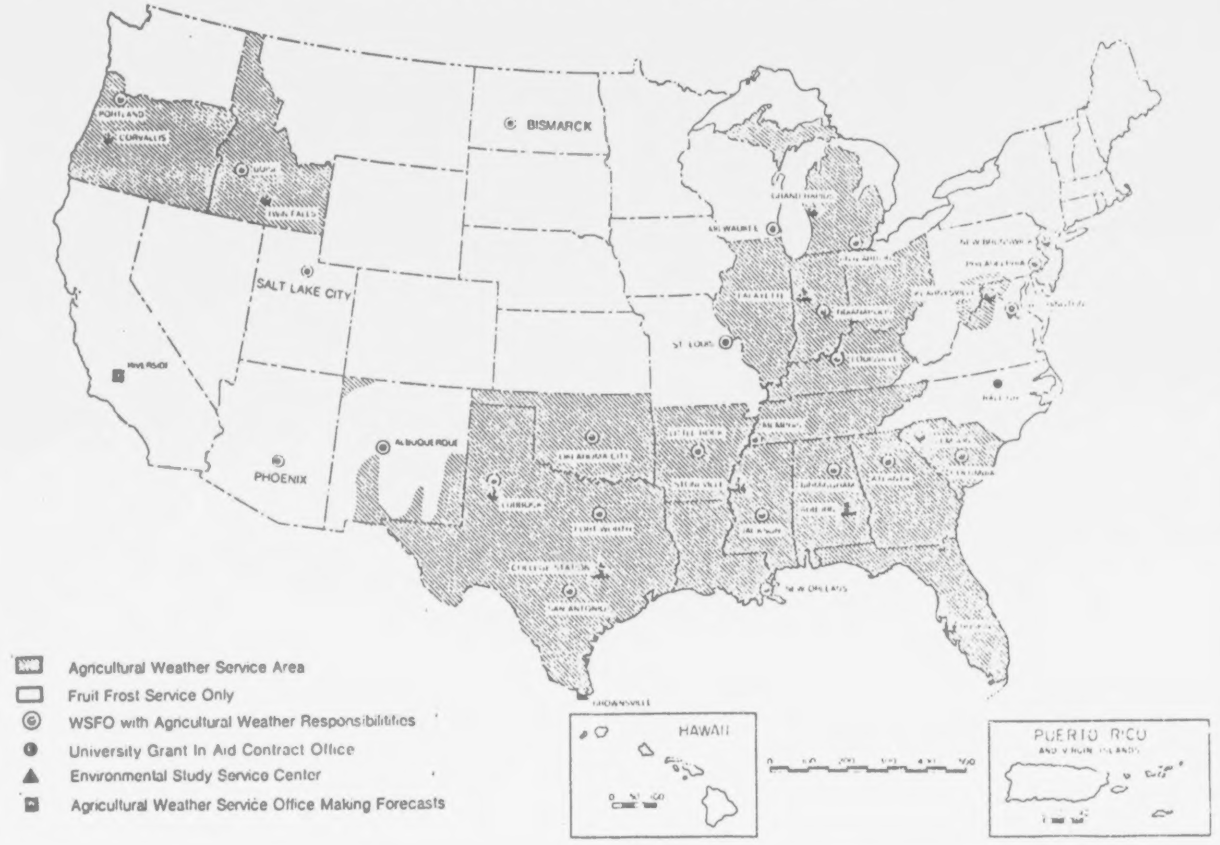
The Department of Agriculture informs farmers of improved agricultural techniques through publications which are not intended to provide real-time notification to every user. State Extension Services and State Agricultural Experiment Stations provide information that is more current through educational programs and publications. A primary information source at the local level is the extension representative assigned to the county, where current advisories and recommendations are disseminated through a variety of means--newsletters, telephone inquiries, office/farm visits, as well as local public media.

NOAA/NWS

The main ingredient of NOAA's programs is weather information. The NWS forecast and services offices around the country issue forecasts of elements such as temperature, humidity, precipitation, and wind that affect crops, livestock, and the virulence of pests. In addition, Agricultural Weather Service Centers (AWSC) have evolved out of the Advisory Agricultural Meteorologist and Environmental Study Service Center programs of the '60s and '70s. These offices are located in the South and Midwest, and adapt the weather information through consultations with state agriculturalists so that it relates specifically to the daily needs of farmers in an average four-state area. In some western states a number of Weather Service Offices provide similar services on a much more localized scale.

Weather information from these offices reaches the farmer through a mix of dissemination modes. The standard NWS systems carry the forecasts and advisories to commercial television and radio - the sources most used by farmers. Telephone recordings, newsletters and farm group seminars, and farm radio network broadcasts are also employed in the more intensive service areas, and some NWS offices transmit data directly to their state counterparts through computer links, where it is included in the agricultural recommendations of that office. In addition, farmers can receive weather information directly from NOAA Weather Radio broadcasts in many areas. Greater detail on the present program is given in Appendix I.

AGRICULTURAL AND FRUIT FROST WEATHER PROGRAM


PORTLAND
CORVALLIS
BOISE
TWIN FALLS
BISMARCK
SALT LAKE CITY
RIVERSIDE
PHOENIX
ALBUQUERQUE
ST. LOUIS
MILWAUKEE
GRAND RAPIDS
LAFAYETTE
INDIANAPOLIS
LOUISVILLE
MEMPHIS
LITTLE ROCK
OKLAHOMA CITY
LUBBOCK
FORT WORTH
COLLEGE STATION
SAN ANTONIO
BROWNSVILLE
JACKSON
BIRMINGHAM
AUBURN
ATLANTA
COLUMBIA
NEW ORLEANS
RALEIGH
NEW BRUNSWICK
PHILADELPHIA
HAWAII
PUERTO RICO AND VIRGIN ISLANDS
▨ Agricultural Weather Service Area
☐ Fruit Frost Service Only
◎ WSFO with Agricultural Weather Responsibilities
● University Grant In Aid Contract Office
▲ Environmental Study Service Center
■ Agricultural Weather Service Office Making Forecasts

NOAA-183

6. PLANS FOR IMPROVING THE NATION'S AGRICULTURAL WEATHER SERVICE

GOALS AND OBJECTIVES

The goal stated in the Foreword to this Plan will be approached through two complementary objectives:

a. To provide the diverse U.S. agricultural community with the latest weather information and weather-related agricultural advisories (currently only about one-third of the country is covered by an operational Agricultural Weather Service).

b. To provide, in a reliable and timely fashion, those specific weather observations and forecasts which are needed to develop and operate crop growth and pest management models.

This plan for a more effective agricultural weather service is based on a joint effort by NOAA (NWS, EDIS, NESS), USDA (SEA), and the states (experiment stations, universities, county agents, and other organizations). The NOAA units will focus resources on developing and refining their weather information capabilities; USDA and the state agencies will concentrate on agricultural information application. Together the information will be disseminated to the farmer.

PROGRAM PLAN

a. Weather Information (NOAA)

The plan to overcome the deficiencies in the ag weather information system as it currently exists makes use of the four AWSC's, and establishes Ag Weather Service Units (AWSU) at nine existing offices. Each of these 13 offices will be responsible for a region covering several states, and will have a dedicated staff of ag meteorologists equipped with processing and communications capabilities to provide full weather sevices for farming in that region. Each WSFO will designate a meteorologist to keep the staff aware of the changing needs of farming in their area.

Observation networks will be upgraded to provide nationwide measurements of such elements as soil temperature and dew duration that are now available in only a few areas. Automated forecast guidance will be developed to pinpoint the weather elements that are important to current agricultural activities. Each AWS office will issue specific ag-weather forecasts, and general advisories based on the public zone forecasts of the WSFO's in their region. The observed and forecast ag weather data for each area will be merged with the basic NWS observations and forecasts into an automated database at the AWSU or AWSC.

This concentration of trained staff, sufficient data, and automated processing equipment overcomes the limitations of the present Ag Weather Service, enabling NOAA to provide:

- Region-specific weather data and forecasts to farmers
- Weather support to farmer education programs
- Weather data and forecast input to crop and pest models

These basic products and services will be provided to ag communities nationwide. However, individual farmers and agribusinesses requiring special forecast and impact models, totally localized data, or special advice should consider enlisting the services of a private meteorologist.

b. Agriculture Information (USDA and State Agencies)

The Science and Education Administration (SEA) of USDA will expand its educational function considerably. SEA, working with the State Cooperative Extension Services and the NWS, is developing an education program to inform farmers and others in the agri-bussiness community about the types and uses of weather information that are available to them. The educational efforts of the state extension offices will find a new outlet through the ag weather liaison positions described in the next section.

Work to adapt research results to routine operational applications must be given high priority. This will require close cooperation between SEA's Agricultural Research and Cooperative Research, units of the NWS, the State Extension Services and Experiment Stations and the state ag weather liaisons.

Long-term plans of SEA-Extension, working with the State Extension Services, include use of videotext services to disseminate agricultural weather forecasts and warnings, agricultural recommendations and advisories, market information, and other data of interest to farmers.

c. Consolidated Agriculture/Weather Information (NOAA, USDA, and the States)

In order that the weather information address the specific, current needs of farmers, and for the agricultural advice to be responsive to the unfolding weather situation, an active exchange of information between the meteorologists and agriculturalists must occur on a routine basis. To accomplish this, ag weather liaison positions will be established in each of the Ag Weather Services offices and in appropriate ag offices in each of the 48 contiguous states. The flow of information will follow the sequence shown in Figure 2.

The total spectrum of weather data and forecast guidance from NOAA services will be available to the ag meteorologists at the Ag Weather Service offices. The meteorologists will be guided by the ag weather liaisons on the staff in constructing the forecasts and general advisories to highlight the current crop operations. This pooling of information between the weather forecaster and the ag liaison is exemplified in the sample advisory in Fig 3. University extension people have advised the forecaster on livestock stress levels and on the current state of the insect problem. Further, they have pointed out the relationships between the livestock safety index and higher ambient temperature ranges as well as optimum weather conditions for treating cotton against plant bugs. The forecaster is alerted to focus his thinking on those elements of future weather conditions that directly influence these production variables and the advisory treats these relationships in considerable detail.

FIG. 2

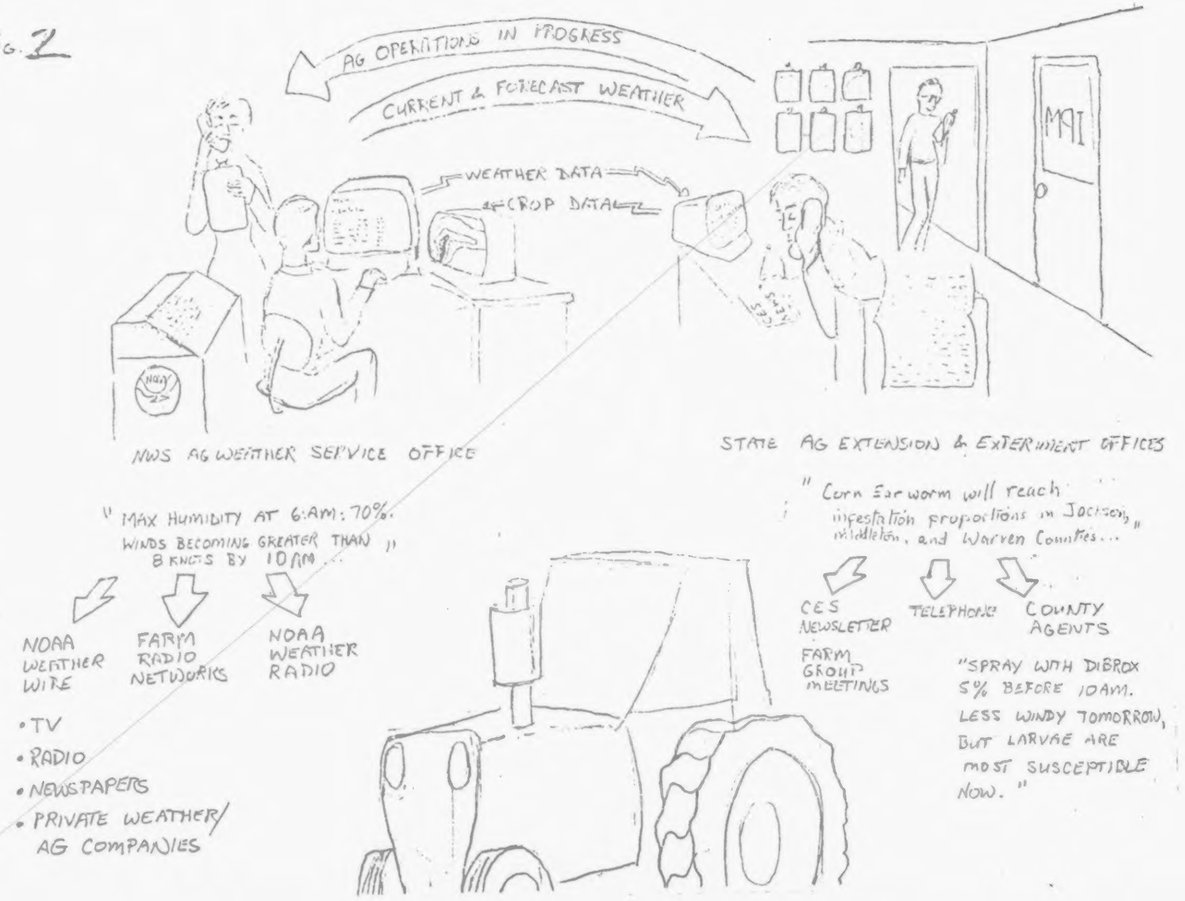
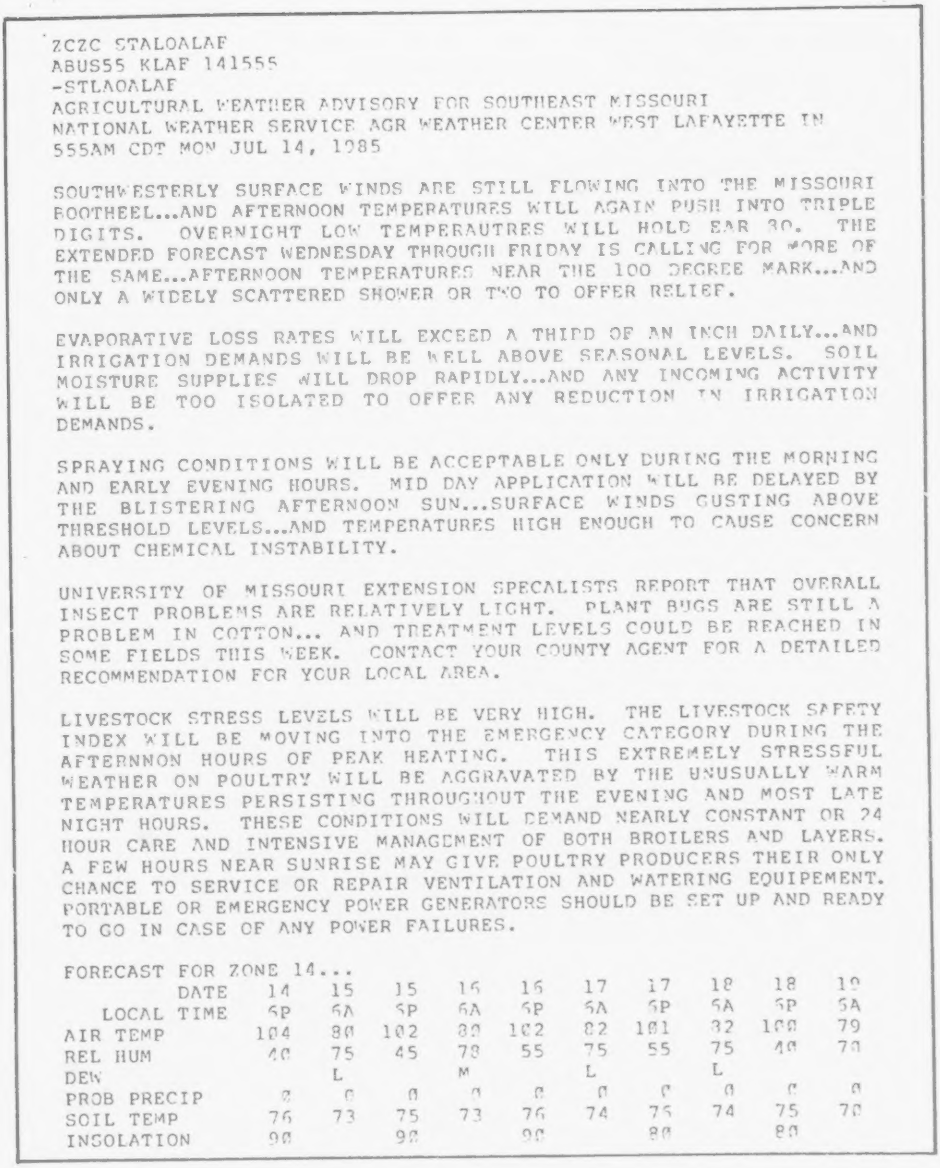

AG OPERATIONS IN PROGRESS
CURRENT & FORECAST WEATHER
WEATHER DATA
CROP DATA
NOAA
CES NEWS
IPM
NWS AG WEATHER SERVICE OFFICE
STATE AG EXTENSION & EXPERIMENT OFFICES
" MAX HUMIDITY AT 6:AM: 70%. WINDS BECOMING GREATER THAN 8 KNOTS BY 10AM... "
NOAA WEATHER WIRE
FARM RADIO NETWORKS
NOAA WEATHER RADIO
• TV
• RADIO
• NEWSPAPERS
• PRIVATE WEATHER/ AG COMPANIES
" Corn Ear worm will reach infestation proportions in Jackson, Middleton, and Warren Counties... "
CES NEWSLETTER
FARM GROUP MEETINGS
TELEPHONE
COUNTY AGENTS
"SPRAY WITH DIBROX 5% BEFORE 10AM. LESS WINDY TOMORROW, BUT LARVAE ARE MOST SUSCEPTIBLE NOW. "

FIGURE 3.



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AGRICULTURAL WEATHER ADVISORY FOR SOUTHEAST MISSOURI
NATIONAL WEATHER SERVICE AGR WEATHER CENTER WEST LAFAYETTE IN
555AM CDT MON JUL 14, 1985

SOUTHWESTERLY SURFACE WINDS ARE STILL FLOWING INTO THE MISSOURI
BOOTHEEL...AND AFTERNOON TEMPERATURES WILL AGAIN PUSH INTO TRIPLE
DIGITS.  OVERNIGHT LOW TEMPERAUTRES WILL HOLD EAR 80.  THE
EXTENDED FORECAST WEDNESDAY THROUGH FRIDAY IS CALLING FOR MORE OF
THE SAME...AFTERNOON TEMPERATURES NEAR THE 100 DEGREE MARK...AND
ONLY A WIDELY SCATTERED SHOWER OR TWO TO OFFER RELIEF.

EVAPORATIVE LOSS RATES WILL EXCEED A THIRD OF AN INCH DAILY...AND
IRRIGATION DEMANDS WILL BE WELL ABOVE SEASONAL LEVELS.  SOIL
MOISTURE SUPPLIES WILL DROP RAPIDLY...AND ANY INCOMING ACTIVITY
WILL BE TOO ISOLATED TO OFFER ANY REDUCTION IN IRRIGATION
DEMANDS.

SPRAYING CONDITIONS WILL BE ACCEPTABLE ONLY DURING THE MORNING
AND EARLY EVENING HOURS.  MID DAY APPLICATION WILL BE DELAYED BY
THE BLISTERING AFTERNOON SUN...SURFACE WINDS GUSTING ABOVE
THRESHOLD LEVELS...AND TEMPERATURES HIGH ENOUGH TO CAUSE CONCERN
ABOUT CHEMICAL INSTABILITY.

UNIVERSITY OF MISSOURI EXTENSION SPECALISTS REPORT THAT OVERALL
INSECT PROBLEMS ARE RELATIVELY LIGHT.  PLANT BUGS ARE STILL A
PROBLEM IN COTTON... AND TREATMENT LEVELS COULD BE REACHED IN
SOME FIELDS THIS WEEK.  CONTACT YOUR COUNTY AGENT FOR A DETAILED
RECOMMENDATION FOR YOUR LOCAL AREA.

LIVESTOCK STRESS LEVELS WILL BE VERY HIGH.  THE LIVESTOCK SAFETY
INDEX WILL BE MOVING INTO THE EMERGENCY CATEGORY DURING THE
AFTERNNON HOURS OF PEAK HEATING.  THIS EXTREMELY STRESSFUL
WEATHER ON POULTRY WILL BE AGGRAVATED BY THE UNUSUALLY WARM
TEMPERATURES PERSISTING THROUGHOUT THE EVENING AND MOST LATE
NIGHT HOURS.  THESE CONDITIONS WILL DEMAND NEARLY CONSTANT OR 24
HOUR CARE AND INTENSIVE MANAGEMENT OF BOTH BROILERS AND LAYERS.
A FEW HOURS NEAR SUNRISE MAY GIVE POULTRY PRODUCERS THEIR ONLY
CHANCE TO SERVICE OR REPAIR VENTILATION AND WATERING EQUIPEMENT.
PORTABLE OR EMERGENCY POWER GENERATORS SHOULD BE SET UP AND READY
TO GO IN CASE OF ANY POWER FAILURES.

FORECAST FOR ZONE 14...
          DATE    14    15    15    16    16    17    17    18    18    19
    LOCAL TIME    5P    6A    5P    6A    5P    5A    5P    5A    5P    5A
AIR TEMP         104    80   102    80   102    82   101    82   100    79
REL HUM           40    75    45    78    55    75    55    75    40    70
DEW                     L           M           L           L
PROB PRECIP        0     0     0     0     0     0     0     0     0     0
SOIL TEMP         76    73    75    73    76    74    75    74    75    70
INSOLATION        90          90          90          80          80
```

The basic thrust in the weather forecast is for hot, dry, southwesterly winds. For the farmer this single piece of information can be applied to a number of field activities and can be manifested in several operational decisions:

Factor(s)	Result	Decision
Hot, windy	Water losses through evapotranspiration	Timing and rate of irrigation
Windy	Excessive dispersion	Spray only during morning; early evening
Dry	Cotton Plant Bugs susceptible	Treat this week
Sustained hot	High livestock stress index	Repair water & ventilation; set up power generators

The weather forecasts, advisories, and modelling data will be disseminated to the farmer much as it is in some areas now. The major improvements will be the computer-based communications that will enable the regional Ag Weather Service offices and the State agriculturalists to share information readilly, and the routine issuance of these specific products in all areas of the country.

On the other side, the Ag weather liaisons in each state will help integrate weather data into the base of information used by the agriculturalists in the extension and research agencies. The state agriculturalists will formulate recommendations for the variety of operations that are under way, and disseminate them through their normal means of educational programs and publications. The recommendations will be adjusted by the county agents to fit the near-term operations and weather conditons. In this way, farmers across the country will be able to factor ag advice that considers up-to-the-minute weather information into their decisions.
In addition to these basic services, some states will add enhancements, such as their own automated communications links to county agent's offices, and individual information systems such as videotext.

The relative locations of the NOAA, State, and County agencies in a representative AWSU area are shown in Figure 4.

7. IMPLEMENTATION OF THE PLAN

As previously described, the improvements in the current system will be accomplished by enhancing the capabilities of the four AWSC's, establishing nine additional AWSU's and establishing ag-weather liasion positions and expanded education programs in each state.

The nine new AWSU's can provide efficient service most economically if located at existing NWS Forecast or Service Offices. Installation costs will be minimized, and the staffs will be able to tap the meteorological skill of the host office. The cost-effective solution for the existing four AWSC's is to upgrade their equipment and staffs without relocating them. The expense of installing equipment and communications lines will be offset by the value of preserving their established contacts within the states and communities.

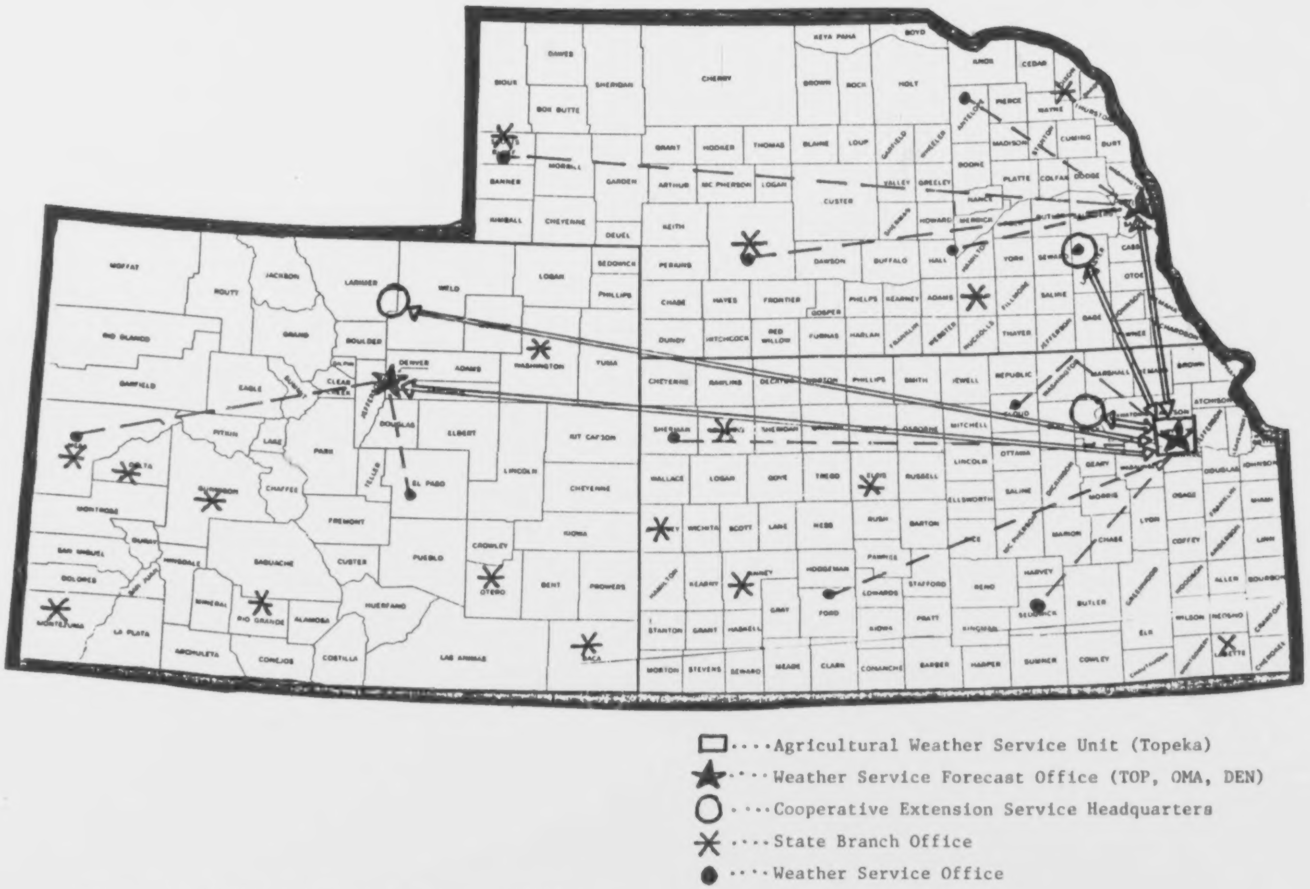

□....Agricultural Weather Service Unit (Topeka)
★....Weather Service Forecast Office (TOP, OMA, DEN)
○....Cooperative Extension Service Headquarters
✳....State Branch Office
●....Weather Service Office

Figure 4. Office locations in a representative Agricultural Weather Service Unit region

PROJECTED YEARLY ESTABLISHMENT OF AG-WEATHER SERVICE OFFICES AND NOAA-SUPPORTED FUNCTIONS

	YEAR1	YEAR2	YEAR3	YEAR4	YEAR5	TOTAL
*NWS technical and management support positions	6	-	-	-	-	6
*AWSC's						
Equipment installed	4	-	-	-	-	4
Ag-Weather Liaison positions installed	8	-	-	-	-	8
*AWSU's						
Construction and equipment installation completed	9	-	-	-	-	9
NWS Ag-meteorologist postions installed	10	15	-	-	-	25
Ag-Weather Liaison positions installed	5	6	-	-	-	11
*State Ag-Weather Liaison positions established	16*	32	-	-	-	48*

* makes use of 7 current agreements

CRITERIA

The priority in the choice of cities for the establishment of Ag-Weather Service Units is predicated on the following considerations:

a) The existence of strong official competence, support, and expression of need on the part of State and county ag agencies must be considered before locating an AWS office. The efforts of the host state will have a significant influence on the success of the service throughout region.

b) The functions and expansion potential of NWS field offices within the region will be considered as a second determinator. AWSU's will be established at offices that have:

1) significant responsibilities within a state;
2) modifiable buildings; and
3) an agricultural service program.

State Ag-Weather Liaison positions within a region will be installed after an AWSU has been established, with the priority being determined according to criterion a).

PLANNED AWS OFFICE LOCATIONS

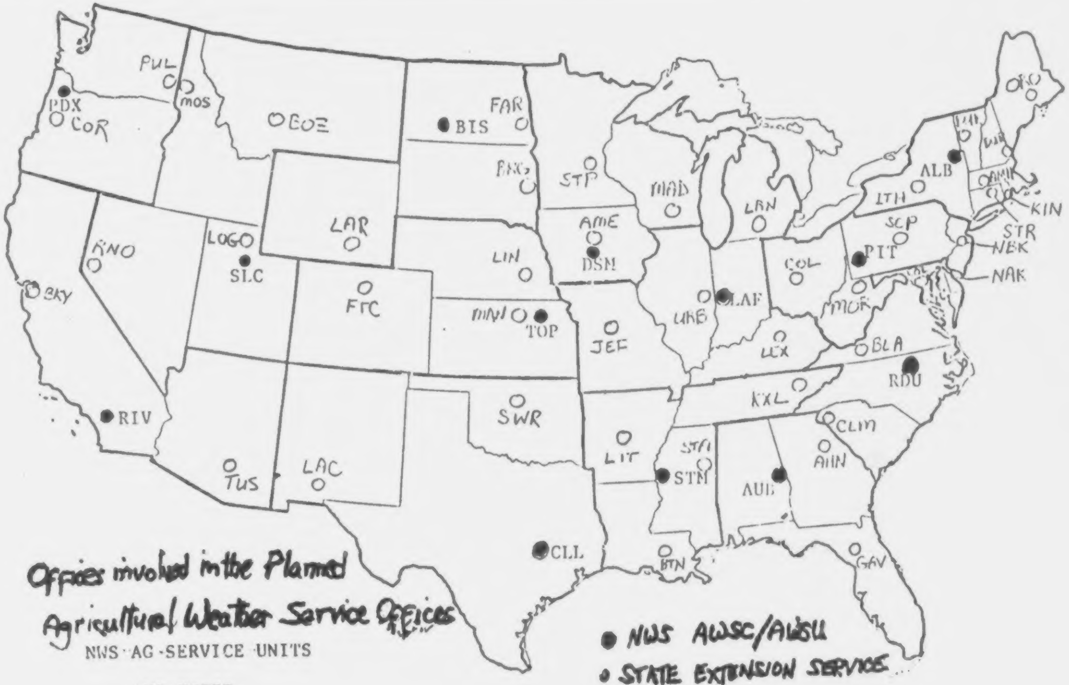
In accordance with the criteria outlined above, the following is the list of locations, in priority order, slated for installation of AWS offices. The previously established Centers will receive staff and equipment modifications as shown.

YEAR1		States Covered
Complete construction modification, and equipment installation	1) Stoneville, MS	MS, LA, AR, TN
	2) College Station, TX	TX, OK, NM
	3) W. Lafayette, IN	IN, IL, MI, KY, MO
	4) Raleigh, NC	NC, SC, VA, MD, DE
	5) Auburn, AL	AL, GA, FL
	6) Bismarck, ND	ND, SD, WY
	7) Des Moines, IA	IA, MN, WI
	8) Topeka, KS	KS, NE, CO
	9) Portland, OR	OR, WA
	10) Riverside, CA	CA, AZ
	11) Salt Lake City, UT	UT, NV, ID, MT
	12) Albany, NY	NY, CT, RI, MA, VT, NH, ME
	13) Pittsburgh, PA	PA, OH, WV, NJ

During YEAR1, AWSC's will be augmented with 8 NOAA-funded Ag-Weather Liasion positions, and Meteorologist-in-Charge positions will be filled for the 9 AWSU's. In addition, an ag-meteorologist position will be filled at Riverside, and Ag-Weather Liaison positions will be filled at Raleigh, Bismarck, Des Moines, Topeka, and Portland. The remaining AWSU staff positions will be filled in YEAR2.

It is anticipated that priority order may be modified and substitutions may be required as agency and community needs vary.

Figure 5. depicts the planned location of AWSC's and AWSU's, and shows the location of the Cooperative Extension Service headquarters in each state.


PDX
COR
PUL
MOS
BOZ
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FAR
STP
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NEK
NAK
RNO
BKY
LOGO
SLC
LAR
FTC
LIN
AME
DSM
MAN
TOP
JEF
URB
LAF
COL
MOR
LEX
BLA
RDU
KXL
RIV
TUS
LAC
SWR
LIT
STA
STN
AUB
AHN
CLM
CLL
BTN
GAV
● NWS AWSC/AWSU
○ STATE EXTENSION SERVICE

Offices involved in the Planned Agricultural Weather Service Offices

NWS AG-SERVICE UNITS

AND THEIR

SERVICE AREAS

Fig 5

8. APPENDIX - DETAILED DESCRIPTION OF PRESENT AGRICULTURAL WEATHER SERVICE PROGRAM

a. Sources and Utilization of Weather Information

At present the primary source of weather forecast information is the network of National Weather Service Forecat Offices (WSFO). Tailored agricultural weather forecasts are issued daily from those WSFO's which have Agricultural Focal Point positions. The forecasts are often appended to the general zone forecasts and include some parameters such as drying conditons and soil temperatures which are not normally provided in the forecasts prepared for the general public. A limited agricultural weather forecast service is provided by a number of WSFO's that do not have Agricultural Focal Points, with tailored forecasts being issued three to seven times per week.

In some areas where WSFO support has not been funded, or where local agriculture is of extraordinary value or is highly diversified, the NWS has designated several Weather Service Offices (WSO) to issue adapted forecasts based on the general public forecasts of the appropriate WSFO. In addition to the regularly scheduled agricultural forecasts, WSFO's or WSO's issue special warnings, such as stockmen's or general frost warnings, as the need arises. A map showing location of WFSO's and WSO's is included as Figure.

The background forecast and observational materials needed by the WSFO's and WSO's in the preparation of their forecasts come from several sources. NWS centers - the National Meteorological Center, the National Severe Storms Forecast Center, the National Hurricane Center, and the Climate Analysis Center - provide national weather advisories and forecasts and computer-aided or generated forecast guidance products. The National Environmental Satellite Service makes available images and digital data from the operational meteorological satellite systems. Over one hundred NWS radar sites across the country supply up-to-the-minute information on storm clouds, with radars of the Federal Aviation Administration supplying coverage in some western states.

Surface observations enter the forecast cycle from a combination of networks. The NWS Synoptic and Basic Weather Networks provide measurements of weather elements that are meaningful to agriculture and other users, such as marine and aviation. Observations are reported four times daily in the synoptic network. Basic observing stations report hourly, and transmit special reports during the intervening periods to record significant weather events. To acquire a more detailed look at the elements that are most important to agriculture such as temperature and humidity of the air, air-motion, sunshine and radiation, soil temperature and moisture, the National Weather Service utilizes a number of cooperative observing stations in representative agricultural areas. Most sites are established under the National Substation Program. As far as practicable, stations in the national climatological and hydrological networks are used where necessary to obtain additional pertinent data. Instruments are furnished and serviced by the National Weather Service, and in most cases the observers serve without pay.

Another cooperative network is being devleoped as a joint NOAA-SEA experiment, for the specific purpose of supporting the agricultural weather program. Extension people recruit the volunteer observers, oversee the installation of the instruments (which the volunteer observer pays for), and provide routine feedback to the volunteer observers. NWS provides a dedicated communications computer and nationwide incoming WATS lines. The volunteer enters the coded data into the computer by keying it from a touch-tone telephone or a touch-tone pad attached to a dial telephone. Observations are reported daily and whenever the volunteer observes a significant weather event .

The cooperative observations from these networks provide a valuable suplement to the National Weather Service's overall observing network, aiding in the preparation of agricultural weather forecasts. They also supply valuable data for preparing agriculture-meteorology technical studies for developing improved forecasting techniques, and for climatological purposes.

Climatological studies published by several offices of NOAA are useful in relating long-term probabilities of the weather elements to agricultural practices. NOAA's National Climatic Center (NCC) routinely publishes summarizations of recent weather and comparisons to the long term normals. This information is useful in seasonal operations (for example, planting and defoliation) and in long-term planning such as determining the capacity required of irrigation systems.

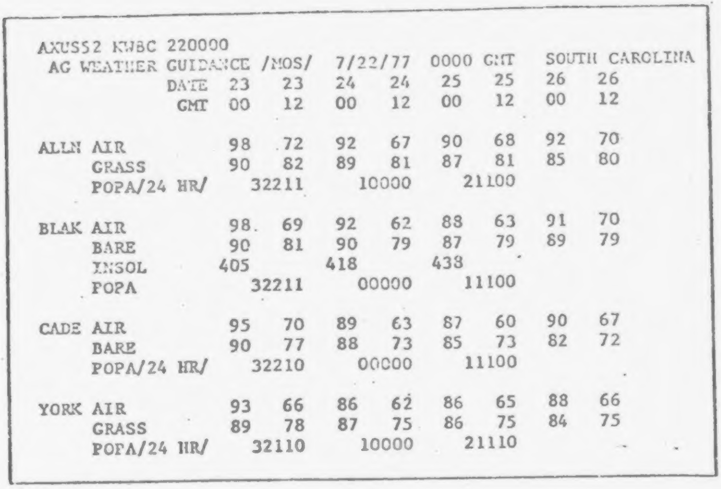
Weather information processing techniques specifically for agricultural forecasting applications are presently being developed by the National Weather Service and the National Environmental Satellite Service. In the field of centralized products, the National Weather Service is adjusting the Model Output Statistics (MOS) program to include agriculturally significant parameters such as dew points, precipitaton amount, and soil temperature. The National Environmental Satellite Service is developing methods of computer analysis of satellite data that will give forecasters a minutely-scaled look at such crop-critical elements as freezing temperatures and heavy precipitation. On the local level, National Weather Service regional and field offices conduct ongoing studies to develop analysis and forecast methods which have applications to agriculture.

b. Agricultural Information Sources and Utilization

The present program is built upon the unique cooperative nature of the relationships between the county, state, and federal agencies involved in providing operational guidance to agricultural concerns. County agricultural agents, who take into account the economic, agricultural, and climatological influences of the county, are one of the farmers' major sources of information. Agricultural specialists in the State Extension Services provide the central guidance of agricultural practices related to their individual expertise, organizing the educational efforts within the state and issuing publications on a weekly and as-needed basis. The Science and Education Administration-Extension of the Department of Agriculture provides the national leadership for the educational and operational aspects of the program.

Present research programs are conducted by Agricultural Research and Cooperative Research (components of the Science and Education Administration), State Agricultural Experiment Stations, and under private grants, with support provided by Federal matching funds through Cooperative Research. The research in agricultural meteorololgy is increasingly focused on problems of weather impacts on crops, livestock and the water and soil resources of the Nation. The goal of the Department of Agriculture's supporting research and development is to provide methods whereby the farmer can utilize pertinent information to determine the most effective course of action to minimize cost, increase efficiency and reduce losses.

The principal research areas carried out in the program are: (1) integrated pest management, where the combined influences of weather and specific pest life cycle are inputs to pesticide choice and application models; (2) weather - crop yield modeling in which the environmental influences - including weather - are used to simulate crop development and yield; (3) soil moisture modeling, involving the development of systematic, objective methods for calculating the soil moisture profile for arbitrary soil types for a full range of precipitation and solar radiation regimes under various field crops; (4) research on environmental factors affecting livestock production, which attempts to identify relationships between weather factors and the growth, development and general health of livestock and poultry - criteria important for optimum management and shelter under a variety of climate and weather conditions.



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AXUS52 KWBC 220000
 AG WEATHER GUIDANCE /MOS/   7/22/77  0000 GMT   SOUTH CAROLINA
                DATE  23    23    24    24    25    25    26    26
                 GMT  00    12    00    12    00    12    00    12

ALLN AIR              98   .72    92    67    90    68    92    70
     GRASS            90    82    89    81    87    81    85    80
     POPA/24 HR/        32211       10000       21100

BLAK AIR              98.   69    92    62    88    63    91    70
     BARE             90    81    90    79    87    79    89    79
     INSOL           405         418         438
     POPA               32211       00000       11100

CADE AIR              95    70    89    63    87    60    90    67
     BARE             90    77    88    73    85    73    82    72
     POPA/24 HR/        32210       00000       11100

YORK AIR              93    66    86    62    86    65    88    66
     GRASS            89    78    87    75    86    75    84    75
     POPA/24 HR/        32110       10000       21110
```
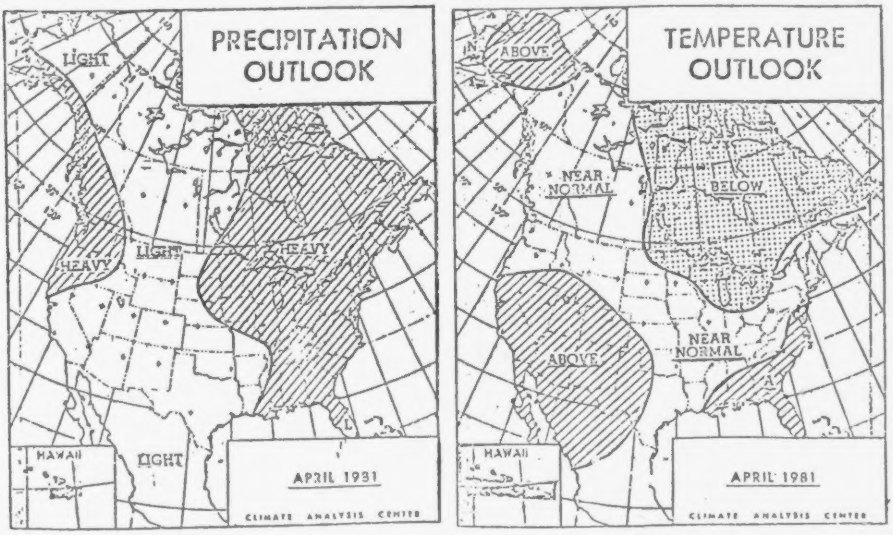
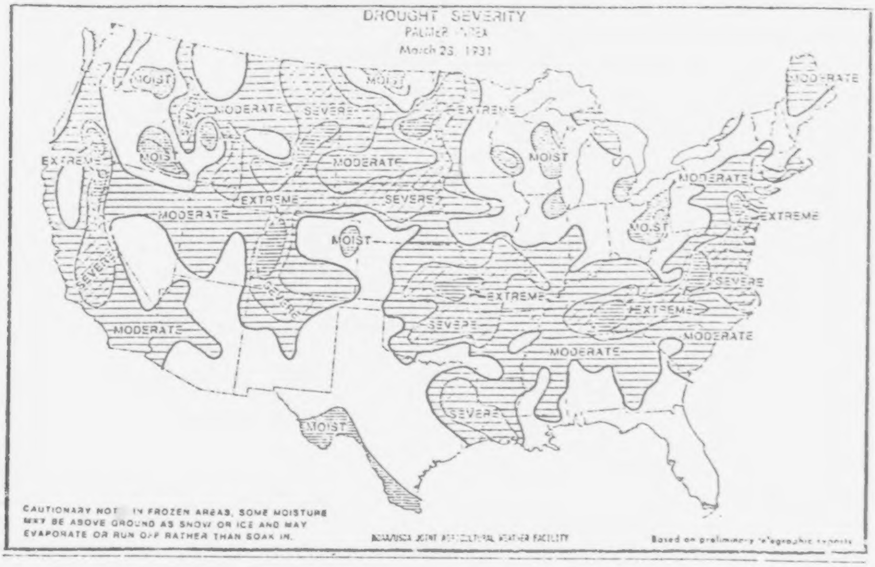

Average Monthly Weather Outlook


PRECIPITATION OUTLOOK
LIGHT
HEAVY
LIGHT
HEAVY
HAWAII
LIGHT
APRIL 1981
CLIMATE ANALYSIS CENTER
TEMPERATURE OUTLOOK
ABOVE
NEAR NORMAL
BELOW
ABOVE
NEAR NORMAL
HAWAII
APRIL 1981
CLIMATE ANALYSIS CENTER

DROUGHT SEVERITY
PALMER INDEX
March 28, 1981


MOIST
MODERATE
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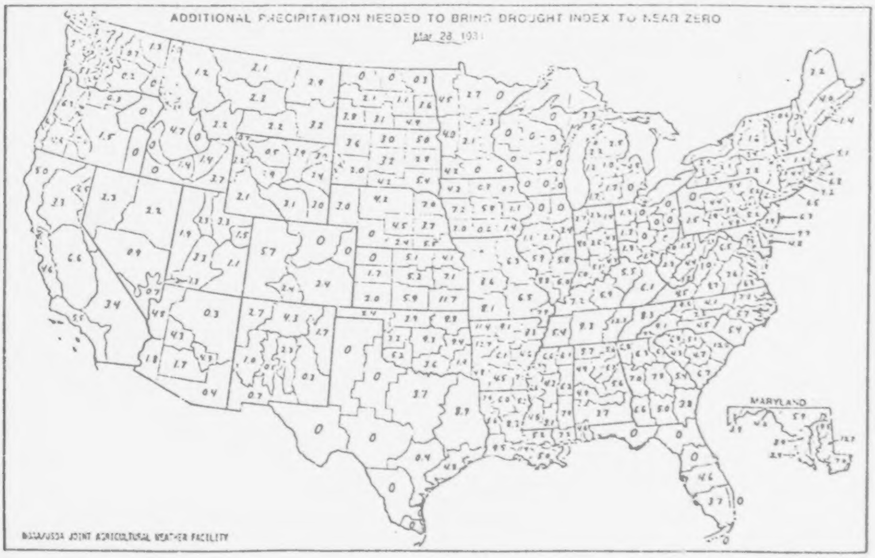
MODERATE
SEVERE
MOIST

CAUTIONARY NOTE: IN FROZEN AREAS, SOME MOISTURE MAY BE ABOVE GROUND AS SNOW OR ICE AND MAY EVAPORATE OR RUN OFF RATHER THAN SOAK IN.

NOAA/USDA JOINT AGRICULTURAL WEATHER FACILITY

Based on preliminary telegraphic reports

ADDITIONAL PRECIPITATION NEEDED TO BRING DROUGHT INDEX TO NEAR ZERO
Mar. 28, 1981



NOAA/USDA JOINT AGRICULTURAL WEATHER FACILITY

FINAL DRAFT

A National Plan for
AGRICULTURAL WEATHER SERVICES

July 1980

Foreword

The goal of this National Plan for Agricultural Weather Services is to provide the Nation's agricultural producers with the weather information and weather-related recommendations they need to maximize production efficiency through weatherwise planning and decision-making. This Plan represents five years of effort by representatives from the Department of Agriculture and the Department of Commerce. It responds to Office of Management and Budget Circular A-62, and has benefitted from the advice and assistance of the Interdepartmental Committee for Meteorological Services and Supporting Research, a number of land Grant University scientists, and representatives of several farmer organizations.

This Plan is directed toward a more effective Federal-State partnership in field agricultural weather services during the 1980's. It makes maximum use of the observational networks and the data-processing and dissemination facilities of the Department of Commerce/National Oceanic and Atmospheric Administration (NOAA) and the Department of Agriculture. The Plan includes supporting agricultural weather observations, research, and training. It does not include service to U.S. Department of Agriculture headquarters; nor does it include specific fire weather or soil conservation weather services.

Plan implementation is discussed in general terms. Details regarding costs and specific tasks are to be updated and published annually in the Federal Plan for Meteorological Service and Supporting Research.

Thomas B. Owen
Federal Coordinator for
Meteorological Services
and Supporting Research

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Appendix I. Present Locations of Agricultural Weather Service Activities

Appendix II. Examples of Specialized Agricultural Weather Forecasts and Advisories

Appendix III. Tables of Agricultural Weather User Requirements

Note.- The Appendices are not included in this draft

1. INTRODUCTION

Food has always been among the major concerns of man. In nearly every period of history, the balance between the amount of food that could be produced and that required to feed an ever-expanding population remained highly tenuous. Several times in recent decades, it appeared that exploding agricultural technology would eradicate the danger of hunger worldwide, but we soon learned the relief was only temporary. Once again the threat of starvation looms on the horizon for a significant part of the world's population.

In contrast to the global perspective, in some countries such as the United States and Canada, food is produced at such a rate that the prices farmers and ranchers receive for their products barely offset production costs. This situation highlights the fundamental problem: How to maintain or increase farm output while holding production costs to levels that will permit the products to be sold at prices affordable by the world's consumers, and provide a fair return to producers who must operate with environmental and energy restraints. Resolution of this dilemma will have to be found by increasing production efficiency using available technology.

Agriculture is made up of many interactive biological systems, all greatly influenced by weather. Weather variations influence seed germination, development of insects, disease, and weeds, the development of the crops and livestock, the efficacy of the chemical control measures and their enviromental impact and the amounts of energy required. Combining weather information and agricultural technology in planning and decision-making is one of the expanding frontiers in improving the production efficiency of American agriculture.

This Plan addresses the needs of the entire agricultural community: the agricultural producers, i.e. farmers, ranchers, and growers; support businesses such as commercial sprayers, shippers, processors, broadcasters, and marketers; and finally, extension staffs and other key State and Federal agencies that support agricultural producers.

This Plan covers all aspects of agricultural weather services: measurements and observations; analysis, forecasts, warnings, and recommendations; climatic information; and supporting research and education. In addition the plan identifies roles, responsibilities, and relationships of the Federal government, the States, and the private sector.

A focused Federal-State partnership is the first requirement for an effective agricultural weather service. This Plan defines the basic components of the partnership.

2. SERVICE CHARACTERISTICS AND USER REQUIREMENTS

The Agricultural Weather Service Program, like all other weather service programs, depends on the existence of a basic meteorological program to supply measurements, analyses, and predictions of the physical state of the atmosphere. In addition, supplementary observation networks are necessary to provide meteorological information on an agriculturally significant scale. The information from these basic and supplementary programs must then be transformed into the needed weather variables and operational information that can be disseminated to and used by the agricultural community.

The operation of an information system that addresses the needs of the agricultural community must satisfy certain fundamental criteria:

- the information must be accurate within the limitations imposed by the current state of the art;
- it must be timely and issued when required;
- the information must be applicable in terms of both content and format;
- the information must be accessible, which means that it must be available at those locations where the user needs the information for operations.

a. Measurements

Essential to the Agricultural Weather Service is an adequate network of meteorological observations to provide real-time data on elements that characterize the physical environment of the agricultural area. As far as practicable, systems should be used that already are integral parts of the national aviation, synoptic, climatological and hydrological networks. Frequently, supplementary data, vital to the quality of the meteorological service provided, is needed. When this occurs, additional observational sites should be established or present sites upgraded for the specific purpose of supporting the Agricultural Weather Service. Normally, daily measurements should include maximum/minimum and current air and soil temperatures, amounts of rainfall, and where feasible, soil moisture, evaporation, dew duration and snow depth. These observations provide an essential supplement to the National Weather Service's basic observing networks, aiding in the preparation and verification of forecasts and advisories and in the evaluation of existing techniques, and providing real-time data for input into integrated pest management and other objective models. The observations also provide valuable data for supporting agricultural meteorology studies and for developing improved forecasting techniques. Finally, detailed observations of the microenvironment also may be required at some locations for use in technical studies of weather/agriculture relationships. Necessary variables include, in addition to the above:

* Total radiation
* Net radiation
* Evapotranspiration
* Temperature gradient in air
* Temperature gradient in soil
* Temperature of foliage
* Temperature of crop level
* Temperature of soil-air interface
* Composition of the air in the biosphere
* Wind (crop level and standard)
* Rainfall (micronetwork)
* Humidity

b. Climatic Information

Given an adequate data base, an agricultural weather service can make its initial contribution at the planning stage of the agricultural activity through the introduction of appropriate climatological summaries. For initial planning, the farm operator needs answers to questions of when, for how long a period, or how frequently will weather conditions be favorable or unfavorable for a particular activity. A second step in planning the operation is to devise a set of alternatives for dealing with adverse weather conditions that may be expected to occur, and to evaluate the capability of the service to warn in advance of the onset of unfavorable weather conditions. Climatological data supplemented by 6-10 day, 30-day and seasonal weather outlooks represent the main information sources for the planning phase.

c. Predictions

In executing daily or weekly operations, weather forecasts become one of the key factors in the farmer's decision process. At present, weather forecasts are superior to other sources of weather data for periods of up to 3 days under most conditions. In certain situations and with certain parameters, such forecasts may remain usable up to 5 days. For maximum utility the agricultural forecasts must be presented in a form compatible with the user's operational decision process, and must include consideration of the ongoing agriculture activity.

d. Dissemination

The information needed by the user must be available at the required times and locations. The criteria governing its dissemination must include timeliness and ease of accessibility. Timeliness of the dissemination must be such that neither the accuracy nor the applicability of the information is degraded through delays in communicating the information. The dominant factors in accessibility are cost and convenience: the cost of gaining access to the information cannot exceed the net value of the information, and the effort required to gain access should not discourage its use.

Under these criteria, several dissemination systems have come into use, ranging from satellite communications to computer terminals, teletypewriters, telephone, NOAA Weather Radio, commercial and public radio and television, or combinations of these. It appears that commercial radio and television media will continue to provide a significant link to the ultimate user of the information. Several innovative systems under development could significantly improve the utility for communicating agricultural weather information. These improvements in dissemination are being further aided by NOAA's upgrading of its basic weather communication system linking all forecast offices with computer-oriented highspeed data lines.

3. BENEFITS

Agriculture is presently experiencing rapidly rising prices for those variable inputs that make up a large part of the cost of production: energy, chemicals, water and machinery. These economic conditions are expected to continue into the foreseeable future. Hence, the making of better plans and decisions for the use of these resources becomes of paramount importance in controlling food prices and maintaining proper levels of farm income. The Agricultural Weather Service can make a major contribution toward the realization of these objectives.

An estimated 25 percent of the herbicides applied in the United States are ineffective because of incorrect timing of application in relation to weather conditions. With a farm value of these herbicides of $1.4 billion, the direct loss to farmers is $350 million annually, plus accompanying costs in labor and energy.

The annual farm value of insecticides, fungicides and nematocides is $1 billion. Research indicates that a 20 percent reduction in use of these products could be achieved from a fully-implemented agricultural weather program to support efforts in Integrated Pest Management. This would reduce farmer costs by $200 million annually, plus accompanying benefits in preserving the environment and energy.

In Indiana, where NOAA-Extension coordination and cooperation has resulted in an effective pest management system, the agricultural extension specialists have estimated that in 1976 more than $11 million in insecticide spraying costs were avoided.

Irrigation is another critical component to this Nation's agriculture. Research at the University of Nebraska shows water use can be reduced 35 percent from a fully implemented agricultural weather service to support programs in irrigation scheduling. In Nebraska alone, this is a savings of $42 million annually. Similar conditions are prevalent in other states.

During a ten-day period in January 1977, growers in two counties in central Florida saved $1.4 million in fuel and other costs because of agricultural weather forecasts and advisories on cold protection issued by the National Weather Service (NWS).

On March 28, 1975, early freeze warnings by NWS enabled a California almond grower to transfer equipment to protect nearly 3,000 acres with a crop value of $4 million.

The Agricultural Weather Service described in this plan will provide the capability for agricultural producers to increase production efficiency and reduce risks associated with weather-influenced operations -- water use, fertilizer use, control of pests, scheduling labor, etc.

4. ROLES OF THE AGENCIES AND RELATIONSHIPS

Because of its primary obligation to protect the national interest and the general welfare, the Federal government incurs specific responsibilities to agriculture through the various laws and regulations promulgated to manage the Nation's agriculture programs. This situation creates an inherent obligation to assist the agricultural community in assuring that these programs are executed with maximum efficiency and effectiveness. Weather and weather-related information can be major factors ... the proper execution of these programs. The Departments of Agriculture and Commerce are charged with providing the majority of Federal services to agriculture. Their specific roles include:

a. Department of Commerce

The Department of Commerce through its National Oceanic and Atmospheric Administration (NOAA), is responsible for:

(1) Basic meteorological services for public safety, welfare, and transportation; these responsibilities include:

- forecasting the weather and issuing warnings for storms and other hazardous weather conditions;
- forecasting and issuing warnings for river flow, floods, storm surges, and surface water supplies;
- observing, reporting, collecting, distributing, processing, and disseminating in cooperation with other Federal agencies, meteorological, hydrological, climatological, and oceanic data and information;

(2) Weather services for the benefit of agriculture, commerce, environmental protection, energy use and conservation, natural resource management and protection, air and marine navigation and safety; including:

- interpretation and conversion of meteorological data into information understandable to agricultural interests;
- issuing agricultural advisories, coordinating the weather information with agricultural recommendations of state extension specialists;
- providing for training of NWS agricultural meteorologists;

"information production" and "information application." The Department of Commerce conducts the activities that produce the weather information and the Department of Agriculture is responsible for educating the agriculture community in the application of weather information to agricultural decision-making.

The National Weather Service provides the weather information and packages and products that meet the needs of a broad spectrum of agricultural weather information users. However, the unique needs of individual farmers, ranchers, and agribusiness firms may not be met through this program. Those private business needs may be more properly the domain of the private sector. The industrial meteorologist can provide a valuable service to the large sophisticated agricultural weather information user whose operations are of such scope and scale as to warrant special advice, the complete localization of the information or the development of special forecast and impact models.

5. PRESENT PROGRAM

The Departments of Commerce and Agriculture share responsibility for providing the agriculture weather field service that includes specialized observations, forecasts, advisories, warnings, assessments of the impact of weather and climate upon agriculture and supporting research directed toward the needs of agricultural interests.

The Department of Commerce plans and performs the service, while the Department of Agriculture carries out or funds supporting research, assists in planning, defines new needs, and cooperates in observing, communicating, and distributing weather information and in developing impact advisories.

a. Sources and Utilization of Weather Information

The primary source of weather forecast information is the network of National Weather Service Forecast Offices (WSFO). Tailored agricultural weather forecasts are issued daily from those WSFO's which have Agricultural Focal Point positions. The forecasts are often appended to the general zone forecasts and include some parameters such as drying conditions and soil temperatures which are not normally provided in the forecasts prepared for the general public. A limited agricultural weather forecast service is provided by a number of WSFO's that do not have Agricultural Focal Points, with tailored forecasts being issued three to seven times per week.

In some areas where WSFO support has not been funded, or where local agriculture is of extraordinary value or is highly diversified, the NWS has designated several Weather Service Offices (WSO) to issue adapted forecasts based on the general public forecasts of the appropriate WSFO. In addition to the regularly scheduled agricultural forecasts, WSFO's or WSO's issue special warnings, such as stockmen's or general frost warnings, as the need arises.

Agricultural weather forecasts and warnings are currently disseminated to the State Extension Services, directly to users, and to the mass media over the NOAA Weather Wire Service, NOAA Weather Radio, telephone, and the press wire services.

The background forecast and observational materials needed by the WSFO's and WSO's in the preparation of their forecasts come from several sources. NOAA's National Weather Service centers - the National Meteorological Center the National Severe Storms Forecast Center, the National Hurricane Center, and the Climate Analysis Center - provide national weather advisories and forecasts and computer-aided or generated forecast guidance products. The National Environmental Satellite Service of NOAA makes available images and digital data from the operational meteorological satellite systems. Over one hundred NWS radar sites across the country supply up-to-the-minute information on storm clouds, with radars of the Federal Aviation Administration supplying coverage in some western states.

Surface observations enter the forecast cycle from a combination of networks. The NWS Synoptic and Basic Weather Networks provide measurements of weather elements that are meaningful to agriculture and other users, such as marine and aviation. Observations are reported four times daily in the Synoptic network. Basic observing stations report hourly, and transmit special reports during the intervening periods to record significant weather events. To acquire a more detailed look at the elements that characterize the physical environment of the agricultural area, such as temperature and humidity of the air, air-motion, sunshine and radiation, soil temperature and moisture, and hydrometeors and other water balance factors, the National Weather Service utilizes a number of cooperative observing stations in representative agricultural areas and within or near various crops or enterprises. Most sites are established under the National Substation Program. As far as practicable, stations in the national climatological and hydrological networks are used where necessary to obtain additional pertinent data. Instruments are furnished and serviced by the National Weather Service, and in most cases the observers, as part of a corps of nearly 12,000 private citizens, serve without pay. Normally, daily measurements are made of the maximum, minimum, and current air temperatures, amount of rainfall, and, sometimes, evaporation and soil temperature. Routine agricultural observations from these cooperative stations are taken in the early morning and are telephoned to the nearest Weather Service Office.

Another cooperative network is being developed as a joint NOAA-SEA experiment, for the specific purpose of supporting the agricultural weather program. Extension people recruit the volunteer observers, oversee the installation of the instruments (which the volunteer observer pays for), and provide routine feedback to the volunteer observers. NWS provides a dedicated communications computer and nationwide incoming WATS lines. The volunteer enters the coded data into the computer by keying it from a touch-tone telephone or a touch-tone pad attached to a dial telephone. Observations are reported daily and whenever the volunteer observes a significant weather event.

The cooperative observations from these networks provide a valuable supplement to the National Weather Service's overall observing network, aiding in the preparation of agricultural weather forecasts in the states shown in Appendix I. They also supply valuable data for preparing agriculture-meteorology technical studies, for developing improved forecasting techniques, and for climatological purposes.

Climatological studies published by several offices of NOAA are useful in relating long-term probabilities of the weather elements to agricultural practices. The National Climatic Center (NCC) of NOAA's Environmental Data and Information Service collects and records weather data from the observation programs of the National Weather Service, the armed forces, the National Environmental Satellite Service, the Federal Aviation Administration, and the National Substation Program. Summarizations of recent weather and comparisons to the long term normals are routinely published and made available to farmers and county agents as a permanent reference. This information is useful in seasonal operations (for example, planting and defoliation) and in long-term planning such as determining the capacity required of irrigation systems.

Analysis and forecasting of short-term climate fluctuations are the responsibilities of the recently formed Climate Analysis Center (CAC) of the National Weather Service. Monthly and seasonal analyses and outlooks, pertinent to short-term agricultural planning activities, are published periodically by the CAC. Weekly tables and maps of elements such as total precipitation, air and soil temperature, and soil moisture are prepared by the CAC for inclusion in the Weekly Weather and Crop Bulletin which is published jointly by the Departments of Commerce and Agriculture. The bulletin also includes cumulative evaluations of seasonal heat units, affording guidance to seed suppliers and farmers in producing and planting varieties adapted to the time remaining after planting.

The development of weather information processing techniques specifically for agricultural forecasting applications is presently being conducted in the National Weather Service and the National Environmental Satellite Service. In the field of centralized products, the National Weather Service is adjusting the Model Output Statistics (MOS) program to include agriculturally significant parameters such as dew point, precipitation amount, and soil temperature. The National Environmental Satellite Service is developing methods of computer analysis of satellite data that will give forecasters a minutely-scaled look at such crop-critical elements as freezing temperatures and heavy precipitation. On the local level, National Weather Service regional and field offices conduct ongoing studies to develop analysis and forecast methods which have applications to agriculture.

b. Agricultural Information Sources and Utilization

The present program is built upon the unique cooperative nature of the relationships between the county, state, and federal agencies involved in providing operational guidance to agricultural concerns. County agricultural agents, who take into account the economic, agricultural, and climatological influences of the county, are one of the farmers' major sources of information. Agricultural specialists in the State Extension Services provide the central guidance of agricultural practices related to their individual expertise, organizing the educational efforts within the state and issuing publications on a weekly and as-needed basis. The Science and Education Administration-Extension of the Department of Agriculture provides the national leadership for the educational and operational aspects of the program.

Present research programs are conducted by Agricultural Research and Cooperative Research (components of the Science and Education Administration), State Agricultural Experiment Stations, and under private grants, with support provided by Federal matching funds through Cooperative Research. The research in agricultural meteorology is increasingly focused on problems of weather impacts on crops, livestock and the water and soil resources of the Nation. The goal of the Department of Agriculture's supporting research and development is to provide methods whereby the farmer can utilize pertinent information to determine the most effective course of action to minimize cost, increase efficiency and reduce losses.

The principal research areas carried out in the program are: (1) integrated pest management, where the combined influences of weather and specific pest life cycle are inputs to pesticide choice and application models; (2) weather - crop yield modeling in which the environmental influences - including weather-are used to simulate crop development and yield; (3) soil moisture modeling, involving the development of systematic, objective methods for calculating the soil moisture profile for arbitrary soil types for a full range of precipitation and solar radiation regimes under various field crops; (4) research on environmental factors affecting livestock production, which attempts to identify relationships between weather factors and the growth, development and general health of livestock and poultry - criteria important for optimum management and shelter under a variety of climate and weather conditions.

c. Consolidated Agriculture/Weather Information Sources

The issuance of advisories and recommendations specifically relating current and expected weather events to ongoing agriculture operations is being done in a number of Federal and State offices. The National Weather Service offices involved in this type of service include the Environmental Study Service Centers (ESSC) and a small number of Weather Service Offices (WSO) with intensive agricultural support functions. The individual states provide consolidated information release through the State Extension specialists. Additionally , in some states NOAA has entered into shared-cost agreements with the Land Grant University, co-funding a state agricultural meteorologist position.

The four ESSC's (see Appendix I.) provide agricultural weather information services covering the major agricultural areas of fifteen states. An ESSC must maintain direct and frequent contact with farmers and agricultural specialists in the states it services, as well as with the WSFO's in those states. When crops are in their most weather-sensitive stages these coordinations will occur several times daily. The result of this multi-disciplined coordination is twofold: WSFO's are kept abreast of ongoing agricultural operations, and concentrate on the weather elements that affect those operations; and agriculture specialists are informed of the ramifications of the weather forecasts and warnings, and may tailor their recommendations accordingly. This information is consolidated in a daily Agricultural Weather Advisory for each state which gives a summary of the expected weather conditions and recommended agricultural operations, usually broken down into regions of the state.

During portions of the growing season when the threat of frost is of critical importance to fruit-growing interests, a number of Weather Service Offices are dedicated - under the Fruit Frost program - to providing support directly to growers. The service includes warnings of low temperatures along with an outlook for the next three to five nights; an advisory service to growers on how to alleviate frost and freezing temperature damage; annual reports on the general character of each season; temperature surveys in agricultural areas; and studies of temperature/crop relationships. This program is concentrated in California and Florida, with lesser services being provided in Idaho, Michigan, Minnesota, Oregon, Utah, Washington, Wisconsin, Texas and Arizona.

The NWS also produces consolidated agriculture/weather information at a number of Weather Service Offices (WSO). These WSO's (see appendix I.) have developed strong relationships with State agricultural specialists and the local agricultural community, and their products include limited, local-scale crop and livestock advisories in addition to the local-scale adapted forecasts.

The State Extension Services issue agriculture recommendations periodically, with potential weather being a factor in the selection of suggested agricultural practices. The Extension specialists can consult with the ESSC staff in those states covered by an ESSC; the grant-in-aid agricultural meteorologist provides consultation for consolidation of weather and agricultural information in Michigan, New Jersey, North Carolina, Oregon, South Carolina, Texas, and West Virginia.

A cooperative research effort involving the study of agriculture-weather relationships is underway, with participation by the Departments of Agricultural, Commerce, and Interior; the National Aeronautics and Space Administration; and the Agency for International Development. The project - "Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing (AgRISTARS)" - will determine the usefulness, cost and extent to which remotely sensed data can be utilized in programs to determine crop conditions, agriculture-weather relationships, and commodity yield/production forecasts.

d. Summary of Present Services

The present agricultural weather service is a collection of programs designed to provide the agricultural interests with weather information and agricultural advice that can improve their efficiency and productivity. The individual programs can be national, regional, or local in scope, depending in part on the available resources of the respective offices.

The programs of NOAA's National Weather Service provide agricultural weather forecasts and warnings and agricultural advisories for a third of the nation, specialized fruit frost warnings and consultations for 11 states, and limited (unfunded) agricultural weather forecast services for 16 states. Staffing and resource limitations prevent these programs from completely satisfying the four fundamental criteria listed on page 3. Basic NWS weather observations are being supplemented by a limited cooperative observer network. The agricultural weather forecasts and warnings do not supply all the desired parameters all of the time, and the dissemination system of NOAA Weather Wire Service, NOAA Weather Weather Radio, telephone, and commercial news media does not assure the timely receipt or complete relay of agricultural information to all agricultural users.

The Science and Education Administration's programs, administered by the Extension Service and Agricultural Research Service, inform the farmer of improved agricultural techniques through publications which are not intended to provide real-time notification to every user. The Extension Service and Agricultural Experiment Stations at the state level, however, are intended to be outlets of more current information, and handle that function through travelling education programs and periodic publications. The County Agricultural Agent is the local information source for agricultural needs, disseminating the most current agricultural techniques recommendations through a combination of newsletters, telephone inquiries, and office visits. The coordination of weather and agricultural information, however, is not being accomplished with any consistency under this arrangement.

6. PLANS FOR IMPROVING THE NATION'S AGRICULTURAL WEATHER SERVICE

The goal stated in the Foreword to this Plan will be approached through two complementary objectives:

a. To provide the agricultural community the latest weather information and weather-related agricultural advisories (currently only about one-third of the country is covered by an operational Agricultural Weather Service).

b. To improve the reliability, accessibility and applicability of measurements and forecasts of critical crop weather parameters.

Achieving these objectives will greatly enhance the effective utilization of agricultural land, labor, and equipment, and will reduce production costs by minimizing agriculture's vulnerability to weather conditions.

This plan for a more effective agricultural weather service is based on the concept of concerted and coordinated efforts by NOAA's National Weather Service (NWS), the Environmental Data and Information Service (EDIS), and the National Environmental Satellite Service (NESS); the Science and Education Administration (SEA) of the Department of Agriculture, the State Extension Services and State Agricultural Experiment Stations, and the Land Grant Universities. The NOAA units will focus resources on developing and refining their "information production" capabilities; the USDA/SEA units and the state agencies will concentrate on "information application." These activities will be directed toward information dissemination at the farm level.

The implementation of this plan calls for a national Agricultural Weather Service structure composed of NWS Weather Service Forecast Offices with agricultural weather focal points; NWS regional agricultural weather support staffs; NWS Environmental Study Service Centers; Weather Service Offices with emphasis on agricultural support; USDA/SEA Agricultural Research and Extension Services; State Agricultural Research and Extension Services; and State Agricultural Meteorologist teams co-funded by NOAA, USDA, and the states. Existing components of the service will be improved and expanded, and new components will be installed in a coordinated manner.

The following program changes are to be implemented in each of the information production areas:

a. Weather Information

Improved, expanded, and more frequently updated and issued agricultural weather forecasts are essential to a high quality agricultural weather service for the nation. The forecasts will be developed around the existing NWS Weather Service Forecast Office (WSFO) operational service. This will require the addition of agricultural weather focal points to the remaining WSFO's, and a concerted development-to-operations program utilizing automated techniques for forecast guidance, preparation, and dissemination.

The Focal Point's responsibilities will be to:

- Design and implement the agricultural weather program at the WSFO
    1. Work with Meteorologist in Charge (MIC) to identify and train interested staff meteorologists
    2. Consult with the agricultural community on necessary weather products
    3. Establish and monitor the agricultural weather forecast schedule
    4. Arrange for the acquistion and use of cooperative agricultural weather observations
    5. Coordinate local and regional NWS scientific support activities
    6. Arrange for dissemination of agricultural weather information on NOAA's Weather Wire and Weather Radio, commercial news media, and videotex systems
- Administer Land Grant University contracts
    1. Negotiate each contract with the Director, State Extension Service under NWS Regional guidelines
    2. Monitor routine advisory issuances for timeliness, adherence to schedule, meteorological content, and program utility

3. Arrange joint agricultural weather seminars for NWS/University agricultural meteorologists

The automated Model Output Statistics (MOS) forecast program will form the backbone of the forecast guidance for the expanded agricultural weather forecast service. MOS capabilities will be expanded, with additional agriculturally-significant parameters included. MOS material will be displayed and editted at the WSFO's and will form the basis for the expanded agricultural weather forecasts.

The expanded forecasts for each agricultural zone also will be provided in matrix-style--time of day along the x-axis, and weather parameters forming the y-axis. Values, designation units or categories would make up the matrix. Air temperatures, soil temperatures, humidity, wind direction and speed, foliage moisture, drying condition, cloud cover and probabilities and amount of precipitation (including frozen precipitation) would be among the parameters included.

Steps will be taken to provide feedback on the accuracy of agricultural forecasts. WSFO focal points will monitor the forecasts, develop verification statistics, and insure that amendments are issued when required.

The NWS Regional headquarters staffs will be augmented to include an Agricultural Weather Program Leader to provide full-time attention and guidance to NWS field activities in each region.

Responsibilities of the Program Leader will be to:

1. Coordinate with the Agricultural Weather Focal Points to ensure and improve the content and timeliness of agricultural weather forecasts issued from the region's WSFO's

2. Coordinate the development of forecast guidance and techniques with appropriate units of NWS
3. Coordinate the inclusion and improvement of agricultural weather information in such NOAA dissemination systems as NOAA Weather Radio and NOAA Weather Wire Service
4. Participate in the formulation of NWS policy on agricultural weather
5. Ensure the accessibility of agricultural weather observations from various networks to the WSFO's in the region
6. Coordinate with River Forecast Centers and River District Offices to obtain maximum application of hydrologic services to agricultural operations to avoid duplication of effort
7. Set Regional standards for agricultural meteorologist contracts according to NWS Headquarters policy and guidance.

As far as practicable, observations from existing basic and cooperative weather observational networks will be used. Additional sites, as needed to maintain the agricultural weather service, will utilize touch-tone telephone or other modern methods to assure timely data acquisition. Instrumentation will be developed and installed at selected NWS sites. Remote automated observation stations will be evaluated on their cost-effectiveness in supplying sufficiently frequent and locally agriculturally-significant weather observations. In addition, the results of the AgRISTARS developmental effort will be used to provide increased spatial resolution of those parameters of importance to agriculture.

b. Agriculture Information

The Science and Education Administration (SEA) of USDA will expand its educational function considerably. SEA, working with the State Cooperative Extension Services and the NWS, is developing an education program to inform farmers and others in the agri-business community about the types and uses of weather information that are available to them. The educational efforts of the state extension offices will find a new outlet through the University teams explained later in this document.

USDA's Science and Education Administration plans an expanded research effort by SEA-Agricultural Research, SEA-Cooperative Research, and the State Experiment Stations that will emphasize the relationship of weather and climate to plants, animals, and the environment, and will develop management systems that can be used by Extension specialists and producers. Research will seek to: determine the effects of weather on the development, behavior, and movement of insects to improve insects management and to improve predictive capability; determine the relationship between weather and climate on such factors as crop hardiness, quality, productivity, and drought resistance; determine the effect of weather on disease development to aid in predicting disease outbreaks; develop improved irrigation management systems; develop systems to predict soil behavior (yield, erodibility, and other behavorial aspects) in varying conditions of climate, land use and management.

Work to adapt research results to routine operational application must be given high priority. This will require close cooperation between SEA's Agricultural Research and Cooperative Research, NWS's Regional Agricultural Weather Program Leaders and the WSFO and ESSC staffs, the State Experiment Stations, and the Land-Grant Universities' teams.

Long-term plans of SEA's Extension Service include the establishment of county-by-county videotex-type services to disseminate agricultural weather forecasts and warnings, University team releases, market information, and other data of interest to farmers via home television receivers.

c. Consolidated Agriculture/Weather Information

The expanded weather and agricultural information services just described will be matched to a dual-faceted program of consolidated information services. The NWS Environmental Study Sevice Center (ESSC) and Weather Service Offices (WSO) with agricultural emphasis will be continued and refined, and the Land Grant University team concept will be established in the states not covered by an ESSC.

Because ESSC's are already oriented toward the operational support of agricultural through routine consolidations of agricultural and meteorological expertise, little change in their functions is proposed. In an effort to achieve a more practical balance of staff size to mission responsibilities, however, the coverage area of an ESSC will be drawn down to an average of two states each, with no alteration in staff size or makeup.

The ESSC's responsibilities, then, will be to:

1. Create and issue advisories (as often as twice daily/7 days per week - as little as once daily/5 days per week depending upon seasonal and local needs)
2. Coordinate the utilization of meteorological information in operational applications programs within NWS and in covered states' programs
3. Provide support for cooperative agricultural weather obsevation networks
4. Provide meteorological expertise for agricultural weather research projects within NWS and in covered states' programs
5. Participate with user/provider advisory committees on agricultural weather support and dissemination
6. Encourage the dissemination of agricultural weather information by commercial broadcast companies

In those states not covered by an ESSC, the Land Grant University agricultural meteorological team structure will be established. NWS will fund two state positions, SEA-Extension will fund another state position, and the state will provide a fourth position (ideally, the State Climatologist) in each non-covered state. This four-person staff will perform many of the functions of an ESSC in that state, with responsibilities according to the interests and existing services within the state.

Generally, the Land Grant University teams will have the following responsibilities:

1. Create and issue advisories (as often as twice daily/6 days per week - as little as once daily/5 days per week)
2. Coordinate meteorological information input to operational applications programs run by the state
3. Coordinate adaptation and input of NWS and University team products to dissemination systems' data bases
4. Provide support for cooperative agricultural weather observation networks
5. Compile and issue periodic state agricultural weather summaries
6. Provide meteorological expertise for agricultural weather research within the state
7. Participate with user/provider advisory committees on agricultural weather support and dissemination
8. Encourage the dissemination of agricultural weather information by commercial broadcast companies.

Where NWS WSO's are currently providing some of these responsibilities, the Land Grant Team will assume a liaison posture to supplement these activities.

7. Implementation of the Plan

In order to effect the improvements and expansion in the Agricultural Weather Sevice that have been described in the previous section, the Departments of Commerce and Agriculture will adopt a carefully designed program for coordinating the implementation of the various components of the service system. The implementation program will draw heavily on the present high level of cooperation that exists among the principals - the National Weather Service; the Science and Education Administration; The State Extension, Cooperative Research, and Agricultural Experiment Stations; and the State Land Grant Universities.

The implementation of the plan will progress along two broad conceptual lines:

- those components of the plan for which a relatively complete body of justifying information exists, through practice or scientific analysis, will progress as resources are made available; and
- the remaining components will progress in the form of a set of pilot experiments designed to test their feasibility and cost-effectiveness with respect to improved agricultural weather services.

An example of the former is the Weather Service Fruit Frost program; of the latter, the videotex agriculture/weather information dissemination system.

The following table sets forth the necessary tasks in general terms. The specific dates, costs, and tasks will be published annually in the Federal Plan for Meteorological Services and Supporting Research.

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FIRST REVIEW DRAFT

INCORPORATING NWS AND USDA-EXTENSION CHANGES

FEDERAL PLAN FOR A
NATIONAL AGRICULTURAL WEATHER SERVICES

W113x1 (RCP) 5/4/79

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Appendix 11. Examples of Specialized Agricultural Weather Forecasts and Advisories*

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* Not included with this draft.

Foreword

This Federal Plan for a National Agricultural Weather Service focuses on the need for providing specialized weather services to farmers, ranchers, and supporting agribusiness interests. It is one in a series of plans issued by the Federal Coordinator for Meteorological Services and Supporting Research to describe present and planned services for specialized user groups. It is a joint plan prepared by representatives from and endorsed by the Department of Agriculture and the Department of Commerce; the plan responds to Office of Management and Budget Circular A-62, and has been prepared with the advice and assistance of the Interdepartmental Committee for Meteorological Services.

This Plan is directed toward a more effective Federal-State partnership in field agricultural weather services during the early 1980's. It makes maximum use of the observational networks and the data-processing and dissemination facilities of the Department of Commerce/National Oceanic and Atmospheric Administration (NOAA) and the Department of Agriculture/Science and Education Administration (SEA). The Plan includes supporting agricultural weather research and training. It does not include services to U.S. Department of Agriculture headquarters.

Plan implementation is discussed in general terms. Details regarding costs and specific tasks are updated and published annually in the Federal Plan for Meteorological Services and Supporting Research.

RICHARD E. HALLGREN
Federal Coordinator for
Meteorological Services
and Supporting Research

1. Introduction

Food has always been among the major concerns of man. In nearly every period in the history of human society, the balance between the amount of food that could be produced and that required to feed an ever expanding population remained highly tenuous. At one time during the past two decades, it appeared that the constant threat to survival imposed by this delicate supply-demand relationship had been forever removed by an exploding agricultural technology. More recently, however, we have come to recognize the relief as only temporary since the upper limits to technology have now become rather clearly visible. Once again, the threat of starvation looms on the horizon for a significant part of the world's population.

In contrast to this global perspective, one is confronted with a vastly different picture in some countries of the world, notably the United States and Canada, in which under most conditions food production takes place at such a rate that the prices farmers and ranchers receive for their products barely offset the cost of production. This situation identifies what is perhaps the fundamental problem in world agriculture: How to increase farm output while holding production costs to levels which will permit the products to be sold at prices that are both affordable for the world's consumers and fair to the farmer. The resolution of this dilemma will have to be found through increased production efficiency within the limits of current technology.

Variations from the so-called "normal weather" provides the greatest risk to the farmer. Through its variability, weather can destroy crops, reduce yields, damage fruits, injure livestock, trigger outbreaks of pests, negate control measures and render labor ineffective, all of which results in the expenditure of unnecessarily large amounts of energy which must be purchased at increasingly high prices. In a sense, weather represents a random process which aperiodically imposes handicaps, hardships, and disruptions of varying magnitude on all aspects of agricultural operations. Its impacts can only be reduced through either weather control or crop phasing. But weather control on a large scale is neither practicable nor desirable; crop phasing or scheduling is both inexpensive and effective. Its only requirements are credible weather information coupled with the flexibility to properly respond to the messages. Improvements in the quality and use of weather information in agricultural planning and decisionmaking represents one of the new frontiers in reducing production costs in American agriculture. This plan, developed jointly by the Department of Commerce and the Department of Agriculture, is designed as a blueprint for exploiting this potential.

The requirements addressed by the plan include those of the entire agricultural community: The agricultural producers,i.e., farmers, ranchers and growers; the various businesses and industries that support the agricultural producers such as commercial crop dusters, shippers, processors, radio and TV broadcasters, and marketers; and finally, extension specialists and other key state and federal officials who also support the agriculture producers.

The plan covers all aspects of agricultural weather service: measurements and observations, forecasts, climatological data and analyses, advice and consultation, and supporting research and education. In addition to the identification of these sets of activities, the plan also identifies roles, responsibilities and relationships, including those of the States and the private sector, issues that are too frequently overlooked in planning

Federal programs. A focused Federal-State partnership is the first prerequisite for an effective agricultural weather service. This Plan defines the basic components of this partnership; it also identifies areas of the agricultural weather service that are the proper domain of the private weather services.

2. Service Characteristics and User Requirements

The Agricultural Weather Service Program, like all other weather service programs, depends on the existence of a basic meteorological program to supply measurements, analyses, and predictions of the physical state of the atmosphere. If the agricultural forecaster is to provide meteorological assistance at a scale equal to the users scale of operation, a supplementary observation network is needed. The information from these basic and supplementary programs must then be transformed into the needed weather variables and operational information that can be disseminated to and used by the agricultural community.

The operation of an information system that addresses the needs of the agricultural community must satisfy certain fundamental criteria: (a) the information must be credible within the limitations imposed by current state of the art; (b) it must be timely in that it must be available at those times when it is required and it must be current in the sense that the system should not permit delays in delivery to the extent that credibility is adversely affected; (c) the information must be applicable in terms of both content and format; and finally, (d) the information must be accessible, which means that it must be available at those locations where the user needs the information for his operations.

a. Measurements

Essential to the Agricultural Weather Service is an adequate network of meteorological observations to provide real-time data on elements that characterize the physical environment of the agricultural area. As far as practicable, systems should be used that already are integral parts of the national aviation, synoptic, climatological and hydrological networks. Frequently supplementary data, vital to the quality of meteorological service provided, is needed. When this occurs, additional ground sites should be established or present facilities upgraded for the specific purpose of supporting the Agricultural Weather Service. Normally, daily measurements should include maximum/minimum and current air and soil temperatures, amounts of rainfall, and where feasible, soil moisture, evaporation, dew duration and snow depth. These observations provide an essential supplement to the NWS basic observing network,aiding in the preparation and verification of forecasts and advisories, and in the evaluation of existing techniques. The observations also provide valuable data for preparing agricultural meteorology studies and for developing improved forecasting techniques. Finally, detailed observations of the microenvironment also may be required at some locations for use in technical studies associated with weather-crop relationships. Variables include in addition to the above:

- Total radiation
- Net radiation
- Evapotranspiration
- Temperature gradient in air
- Temperature gradient in soil
- Temperature of foliage
- Temperature of crop level
- Temperature of soil-air interface
- Soil moisture
- Composition of the air in the biosphere
- Duration and amount or dew and/or leaf wetness
- Wind (crop level and standard)
- Rainfall (micronetwork)
- Humidity

b. Cimatic Analyses

Given an adequate data base, an agricultural weather service can make its initial contribution at the planning stage of the agricultural activity through the introduction of appropriate climatological summaries. For initial planning, the operator needs answers to questions of when, for how long a period, or how frequently will weather conditions be favorable or unfavorable for a particular activity. A second step in planning the operation is to devise a set of alternatives for dealing with adverse weather conditions that may be expected to occur, and to evaluate the capability of the service to warn in advance of the onset of unfavorable weather conditions. A complete picture of the weather for the entire period in question (planting period through harvest and fallow) is desirable. However, the period in question is usually too long to be covered by a forecast obtained by extrapolating from an initial set of conditions. Therefore, climatological data form the basis of outlooks that will be used for the second planning phase.

c. Predictions

In executing the current operation, conventional weather forecasts, based on the extrapolation of a set of initial and boundary conditions, become one of the key factors in the decision process. This is true as long as conventional forecasts have a higher informational content and credibility than do other sources of information on expected weather conditions. At present, conventional forecasts are superior to other sources of weather data for periods out to about 72 hours under most conditions. In certain situations, such forecasts may remain usable up to 5 days. For maximum utility, however, the agricultural forecasts must be presented in a form compatable with the users operational decision process. Meteorological phenomena must be defined in terms of the operational requirements and the forecasts must include consideration of the ongoing agriculture activity. The quality of the meteorological service can only be measured in terms of dollars saved/lost due to prudent operational decisions supported by meteorological information.

This concept generates an overriding need for an agricultural weather service which is completely integrated and fully specialized in terms of its three basic components: observations, climatological analyses, and forecasts. Observations must supply the current measurements and reports of the appropriate atmospheric elements and phenomena; climatology must organize, summarize, and present the data in proper form for planning and designing operations and for highlighting forecast problems; and forecasts must supply the real-time probability functions or expectancies of the elements and phenomena required for daily operational decisions.

d. Dissemination

Once the information needed by the user has been produced in the proper form, the problem of making it available at the required times and locations must be addressed. The criteria governing its dissemination must include timeliness and ease of accession. Timeliness of the dissemination must be such that neither the credibility nor the applicability of the information is degraded through delays in communicating the information. The dominant factor in accessibility is cost and convenience: the cost of gaining access to the information can't be allowed to significantly impact the net value of the information, and the effort required to obtain it should not discourage its use.

Under these criteria, several dissemination systems have come into use, ranging all the way from satellite communications to computer terminals, telephone, radio and television, or combinations of these. It appears that radio and television will continue to provide the primary final link to the ultimate user of the information. This prospect is certainly reinforced by the fact that recently several innovative schemes have come under development that should significantly upgrade the utility of these media for communicating agricultural weather information. These improvements in dissemination are being further aided by NOAA's upgrading its basic weather communication system linking all forecast offices with computer-oriented highspeed data lines.

Providing high quality dissemination in the rural areas continues to be of prime importance. Both the Congress and the executive agencies are giving increased attention to this need. At present, no proposals have been written into law, but such developments will have major impacts on the dissemination of agricultural weather information.

3. Benefits

The benefits of agricultural weather service, although difficult to quantify, are substantial. Weather-related agricultural losses in the United States have been estimated to amount to several billions of dollars annually. Although less than one-half of the total losses are avoidable or protectable, U.S. losses of this type alone have been estimated at about $3.5 billion annually.

Actual reduction of avoidable farm losses due to weather depends upon a number of things. First, the producer must be aware of impending unfavorable weather with ample lead-time to take protective action. Second, he must know what the impact of the impending weather will be. Thirdly, he must know what cultural operations or practices are required for reducing weather-induced losses with each weather situation. Finally, he must be motivated to take action.

Producer decisions strongly impacted by climatic odds and weather expected in coming days include those on crop planting, irrigation, application of fertilizer and pesticides, opening of drainage ditches in fields, hay cutting, crop harvesting, crop drying and poultry and livestock production and transport. All of these and other weather-sensitive farm operations have been documented in varying degrees of detail. Case studies that include evaluations of economic impacts have been carried out in several areas, particularly with regard to freeze protection and plant insect and disease control.

As an example of the value of agricultural weather forecasts and advisories in cold protection, the Florida Cooperative Extension Service has estimated that the National Weather Service (NWS) saved the growers of just two counties in central Florida $1.4 million in fuel and other costs over one 10-day period in January 1977.

Another example of the value of freeze predictions has been cited by a California grower who placed a gross value of $4 million on the crop saved on March 28, 1975. In this case, early warning of an impending freeze allowed time to transfer movable equipment and protect nearly 3,000 acres of a valuable almond crop.

As an example concerning plant disease control, prior to 1967 shade tobacco growers in north Florida and south Georgia suffered documented losses of up to $1 million dollars annually from weather fleck, a malady of cigar wrapper tobacco. Then, in 1967 a special weather-ozone advisory service based on 4 years of research by meteorologists, agronomists, plant pathologists, and soil scientists was begun. By following recommended cultural practices and making maximum use of ozone weather advisories, growers have been able to keep ozone-induced losses to about $10 thousand annually beginning with 1967.

Avoidance of some of the costs of spraying fruit trees has been attributed to agricultural weather services in Michigan. In one area of western lower Michigan, agricultural extension specialists have estimated that agricultural weather forecasts and advisories save on the average, two apple scap sprays annually, i.e., over $200,000 annually for 20,000 acres of apples. Similar rates of savings have been estimated for the apple crop in northeast lower Michigan and for a tree pest management program in southeast lower Michigan. Annual savings for the three areas combined are estimated to exceed $1 million.

In Indiana, agricultural extension specialists have estimated that insecticide spraying costs avoided in 1976 totaled $11,250,000. Indiana extension specialists also have reported that in 1977 "the soil was so dry that soybeans were not planted until the agricultural weather advisory made a strong recommendation for the planting data." Then, "based on advisories the five million acres were planted; it rained two days later and the seeds germinated...and the NWS was credited with saving $84 million" - based on a $14 per bushel cost of seeds.

4. The Roles of the Agencies and Relationships

a. Department of Commerce - The Department of Commerce through its National Oceanic and Atmospheric Administration (NOAA), is responsible for:

- Forecasting the weather and issuing warnings for storms and other damaging weather conditions;
- forecasting and issuing warnings for river flow, floods, storms surges, and surface water supplies;
- forecasting and issuing warnings for weather-related oceanic conditions and for seismic seawaves;

- weather forecasts, advices, and warnings for the benefit of agriculture, commerce, environmental protection, energy use and conservation, natural resource management and protection, air and marine navigation and safety, public safety and welfare, and transportation;
- providing climatological services;
- observing, reporting, collecting, distributing, processing, and disseminating in cooperation with other Federal agencies, meteorological, hydrological, climatological, and oceanic data and information;
- conducting research and development in connection with the above functions and activities including the study of thunderstorms, tornadoes, hurricanes, and other severe environmental disturbances;
- developing coordinated interagency operational plan for providing specialized weather services;
- interpretation and conversion of meteorological data into information understandable to the user;
- providing for training of agricultural meteorologist.

b. Department of Agriculture - Broadly speaking, the Department of Agriculture is responsible for the well being of American agriculture to insure that the Nation is furnished with adequate supplies of food and fiber produced on American farms, rangelands and forests. In this capacity, USDA is responsible for assuring that those agricultural weather services which are an inherent obligation of the Federal government are of the proper quality and available equally to all sectors of the agricultural community. The execution of these general responsibilities frequently gives rise to difficult problems and complex issues. Through its primary obligation to protect the national interest and the general welfare, the Federal government incurs specific responsibilities to agriculture through the various laws and regulations promulgated to manage the Nation's agricultural programs. This situation creates an inherent obligation to assist the agricultural community in assuring that these programs are executed with maximum efficiency and effectiveness. As noted above, weather information can be a major factor in the proper execution of these programs.

c. Relationships - The separation of the roles and responsibilities of the Department of Commerce and the Department of Agriculture lies at the boundary between those areas which might be called "information production" and "information application." The Department of Commerce conducts the programs which produce the information; the Department of Agriculture is responsible for managing programs which enhance its application and utility. These USDA programs serve to translate the weather observations, analyses, and forecasts of environmental variables, i.e., temperature, humidity, precipitation amount and probability, wind, sky condition or insolation, etc., into measures of impacts, decision aids, guidelines, or operational strategies.

Research activities within the Science and Education Administration and the State Agricultural Experiment Stations have a key role in providing the basis for development and operation of a viable agricultural weather service.

The role of the State Extension Services include: establishing and operating rural weather observation networks in cooperation with NWS field staff, developing weather-related agricultural recommendations for farmers, working closely with agricultural meteorologists to keep them abreast of weather information needs critical to current farm operation, helping disseminate agricultural weather forecasts to farmers and ranchers, and conducting an education program to teach farmers and ranchers how to get maximum use of the information.

A partnership between certain State agricultural research scientists, extension specialists and meteorologists working toward improving agricultural weather services is essential. Scientists developing models for pest management, irrigation scheduling, and cultivation practices are among the scientists with whom interdisciplinary collaboration is essential.

Clearly, the National Weather Service should provide only those information packages and products that respond to the needs of a broad spectrum of agricultural weather information users. The unique needs of specific individual farmers, ranchers, and agribusiness firms may not be supplied through this Federal program. Those private business needs are more properly the domain of private weather service organizations.

The industrial meteorologist can provide an invaluable service to the large sophisticated agricultural weather information user whose operations are of such scope and scale as to warrant special advice, the complete localization of the information or the development of the special forecast and impact models. The American Meteorological Society maintains a directory of the reputable private weather service organizations.

5. Present Program

The Department of Commerce and Agriculture share responsibility for providing the Agriculture Weather Service that includes specialized observations, forecasts, advisories, warnings, assessments of the impact of weather and climate upon agricultural production, and supporting research directed toward the needs of agricultural interests.

The Department of Commerce plans and performs the service, while the Department of Agriculture carries out supporting research, assists in planning, defines new needs, and cooperates in observing, communicating, and distributing weather information and in developing impact advisories.

a. Daily Advisory Services to Farmers and Ranchers

Currently the National Weather Service (NWS) is working in concert with State Extension Service, county agricultural agents, universities, and directly with individuals in the agricultural community. Because of this team relationship, timely and detailed weather forecasts and agricultural advisories tailored to current agricultural operations are issued daily. The existing program provides this complete service to Texas, Oklahoma, Arkansas, Louisiana, Mississippi, Alabama, Georgia, Florida, Tennessee, Kentucky, Illinois, Indiana, Ohio, Michigan and parts of New Mexico, 15 states out of 33 with major agricultural interests (greater than 10 million farm acres per state).

Weather forecasts for agricultural users -- ranging from a short-period forecast that affects planting, harvesting, crop dusting, and spraying to a 30-day and seasonal outlook for general agricultural planning -- are prepared at National Weather Service Forecast Offices (WSFO). Interpretive services are provided by advisory agricultural meteorologists. A service for livestock producers in Wyoming and North and South Dakota makes recorded forecasts and warnings continuously available by telephone from mid-October to mid-May. Such special services for fruit and vegetable growers are also available in New Jersey and Michigan.

A special fruit-frost service is concentrated in the western states, Wisconsin and Florida. This service has been integrated into the Agriculture Weather Service in western lower Michigan, the lower Rio Grande Valley, New Jersey, Utah, and in West Virginia. The service provides warnings of low temperatures for specific stations along with an outlook for the next three to five nights; an advisory service to growers on how to prevent frost and freezing temperature damage; annual reports on the general character of each season with respect to crop-weather relationships; temperature surveys in agricultural areas; and studies of temperature and crop relationships.

In an effort to improve further the Agriculture Weather Service, existing resources are being concentrated into the new Environmental Studies Service Centers. The first was established at Auburn, Alabama, to serve Alabama, Florida and Georgia; the second, located at Stoneville, Mississippi, serves Arkansas, Louisiana, Mississippi, and Tennessee; the third to serve New Mexico, Oklahoma, and Texas from a location at College Station, Texas, and the fourth to serve Illinois, Indiana, Kentucky, Michigan and Ohio from a location at Lafayette, Indiana.

The Centers provide:

- Agricultural weather summaries and advisories;
- Technical studies relating weather to agriculture (cooperatively with USDA);
- Consulting services for agricultural research efforts;
- Liaison services with agricultural organizations and users.

A further effort to improve this service has been made through agreements between NOAA and the states of Iowa, Kansas, Minnesota, Nebraska, North Carolina, and South Dakota. These agreements provide for current exchanges of information between the respective WSFO's and the State Agricultural Extension Services. On the basis of this guidance the WSFO's issue forecasts three times a week directed to current agricultural needs.

b. Dissemination

Agricultural weather forecasts, warnings, and advisories are currently disseminated to the State Extension Services, directly to users, and to the mass media over the NOAA Weather Wire Service, NOAA Weather Radio, telephone and the press wire services.

While these dissemination techniques were "good enough" in the past, these are insufficient for todays agricultural efforts. The farmer and rancher today operates an advanced technological business and requires highly specialized weather information at random times. A dissemination system that he can interact with, represents a minimum for today's extremely weather-sensitive operations.

c. Climatology

Climatological studies provided by the Environmental Data and Information Service and National Weather Service, relating the long-time probabilities of the weather elements to agricultural practices, supplement the forecasting services. These studies are published and made available to farmers and county agents as a permanent reference to be used in conjunction with the forecast service. This information is useful in seasonal operations (for example, planting and defoliation) and in long-term planning such as determining the capacity required of supplementary irrigation systems.

Water use by evaporation and transpiration is calculated and related to soil water capabilities and rainfall received. State and national bulletins contain weekly tables and maps of currently available soil moisture in comparison with normals. These same bulletins also monitor progress of the season in terms of heat accumulated for crop development and actual stages of development attained. By providing normal total seasonal heat units, guidance is afforded seed suppliers and farmers in producing and planting varieties adapted to the time remaining after planting. These cumulative evaluations are part of the management process which modern scientific farming employs.

In tailoring climatological information to individual needs, a consulting meteorologists may be found highly desirable. A list of recommended consultants may be obtained from the American Meteorological Society.

d. Agricultural Weather Observations

One of the prime requirements of the Agricultural Weather Service is an adequate network of observing stations to provide data on elements that characterize the physical environment of the agricultural area. Parameters may include some or all of the following: temperature and humidity of the air, air-motion, sunshine and radiation, soil temperature and moisture, and hydrometeors and other water balance factors. To provide such data, the National Weather Service utilizes a number of cooperative observing stations in representative agricultural areas and within or near various crops or enterprises. As far as practicable, the stations used are already integral parts of the national climatological and hydrological networks; where necessary to obtain pertinent data, additional sites are established for the specific purpose of supporting the Agricultural Weather Service. Instruments are furnished and serviced by the National Weather Service, and in most cases the observers, as part of a corps of nearly 12,000 private citizens, serve without pay. Normally, daily measurements are made of the maximum and current air and soil temperatures, amounts of rainfall, and, sometimes, evaporation.

Routine agricultural observations from these cooperative stations are taken in the early morning and are telephoned to the nearest Weather Service Office. These observations provide an essential supplement to the National Weather Service's overall observing network, aiding the Weather Service Forecast Office preparing agricultural forecasts.

These observations also provide valuable data for preparing agriculture-meteorology technical studies and for developing improved forecasting techniques.

e. Education and Training

The National Weather Service has sponsored special Agricultural Meteorological Institutes in various parts of the country. The objective of this program has been to familiarize meteorologists with agricultural weather relationships. The curriculum includes micrometeorology, microclimatology, or agricultural meteorology and agricultural sciences.

Although completion of such a course of study does not make an expert agricultural scientist of the meteorologist, it does provide him with a clear picture of the problems of agriculture and their relation to weather phenomena, and facilitates the exchange of ideas between meteorologists and agriculturists. The agricultural education and training program will, therefore, continue to support these Institute as an instrument for training agricultural forecasters.

f. Supporting Research and Special Studies

Present research programs are conducted by Agricultural Research and Cooperative Research (components of the USDA Science and Education Administration), and by State Agricultural Experiment Stations with support provided by Federal matching funds through Cooperative Research. The research is concerned with the identification of weather effects on crops, livestocks, soils and water resources.

The research in agricultural meteorology is largely focused on problems of weather impacts on crops, livestock and the water and soil resources of the Nation. The outputs from the research as they relate to the Agricultural Weather Service are comprised of models for determining effects of specific weather events and episodes and the guidelines for actions that will reduce the adverse impacts.

The principle research areas carried in the program are: (1) crop-weather yield modeling in which the environmental influences, including weather, are used in combination with agronomic practices to simulate crop development and yield. (2) soil moisture modeling, involving the development of systematic, objective methods for calculating the soil moisture profile for arbitrary soil types for a full range of precipitation and radiation regimes under various field crops.

These efforts will undergo a modest expansion to support the crop modeling efforts and also to improve water management practices. (3) research on environmental factors affecting livestock production attempts to identify relationships between weather factors and the growth, development and general health of livestock and poultry. Criteria for optimum management and shelter under a variety of climate and weather conditions results from this work.

The results of the above research are designed ultimately to make the way into the weather service operation through development efforts involving the adaptation and engineering of fundamental relationships into models and other devices that can be operated on routine basis. The goal of the Department of Agriculture's supporting research and development is to provide methods whereby the farmers can determine the most effective course of action to minimize his costs, increase efficiency and reduce losses.

The educational and training activities of the Department of Agriculture supporting Agricultural Weather Services are for the most part confined to the publications programs of the Science and Education Administration and the Soil Conservation Service. While these publications only occasionally provide information regarding current weather phenomenon, they do supply information on protective measures to be applied in weather induced disease or insect outbreaks, major stress conditions produced by long-continuing drought, and guidelines for selecting crop varieties or livestock breeds to minimize the adverse impacts of weather phenomena.

6. Plans for Improving the Nation's Agricultural Weather Service

The basic objectives of this plan are:

(1) Provide the agricultural community the latest weather information and weather-related agricultural advisories. Currently only about one-third of the country enjoys an operational agricultural weather service.

(2) To improve the reliability, accessibility and applicability of the information and forecasts of critical crop weather parameters. Achieving these objectives will greatly enhance the effective utilization of agricultural land and labor, and will reduce production costs by minimizing agriculture's vulnerability to weather conditions.

This plan for a more effective agricultural weather service is based on the concept of concerted and coordinated efforts by the National Weather Service (NWS), the Environmental Data and Information Service (EDIS), and the National Environmental Satellite Service (NESS), all of the Department of Commerce/NOAA, the Science and Education Administration (SEA) of the Department of Agriculture, the State Extension Services and the State Agricultural Experiment Stations.

The following program changes are to be implemented:

a. Daily Advisory Services to Farmers and Ranchers

Expanded, direct daily advisory services to the farmer:

These new services are to be developed around the existing advisory agricultural weather programs of the NWS, augmented by new methods for applying weather data to day-to-day on-farm decisions. These advisory services will include such items as: 1) irrigation recommendations based on moisture balance models utilizing past, current and forecast weather data; 2) spraying advice based on pest management models; 3) planting advisories based on soil moisture and temperature measurements and forecast; 4) freeze damage warnings based on new satellite derived temperature fields and damage assessment models; 5) wind chill and environmental stress advisories.

The NWS will provide the specialized conversion of all meteorological and weather data into parameters and measures of impact that are most pertinent to agricultural operations. Specifically the agricultural meteorologist and State Extension personnel will be responsible for issuing daily advisories which describe how recent and forecast weather events will affect current agricultural operations and issuing joint releases on agricultural interpretations of the daily short and extended range forecasts. This will require that the NWS conduct the following activities:

- Cooperate with State Extension Services in identifying agriculture's requirements for weather information and provide this information to forecasters.
- Maintain liaison with State Extension Services, State Experiment Stations, and other agricultural agencies, as well as mass news disseminators.
- Cooperate with River Forecast Centers in River District Offices to obtain maximum application of hydrological services to agricultural operations to provent duplication of effort.
- Cooperate with State Extension Services in planning, operating and evaluating the Extension/NWS agricultural weather network.

b. Dissemination

Improve dissemination of agricultural weather information:

There is a need to improve the accessibility of the information through the adaption of new and more efficient methods of communications with farmers. The Department of Agriculture and NOAA are experimenting with various new technologies for more efficient and more accessible means for communicating information to producers directly onto farms in an "available on demand mode." The communications required for disseminating agricultural forecasts, advisories, summaries, and related information to mass media and other interested subscribers will be mainly by the NOAA Weather Wire Service. Continuous radio transmission facilities provided for under other National Weather Service programs will be used where they exist to supplement mass media dissemination as required.

c. Climatology

Increased climatological services:

Plans for agricultural climate information services beyond those currently provided -- in County Soil Surveys, for example -- are being developed under requirements and schedules specified by the National Climate Program Act (PL 95-367).

d. Agricultural Weather Observations

The ability to provide accurate and meaningful forecasts for an agricultural area depends to a large extent on the availability of weather observations from sites which are representative of conditions in thos areas. Special agricultural observing sites will be established as required to augment the existing national climatological and hydrological networks. The number of sites required will be a function of size of the area, topography, types of agriculture, and weather variability. In addition, a developmental effort will begin in FY 1980 to blend environmental satellite derived data with conventional observations to provide increased spatial resolution of those paramaters of importance to agriculture.

e. Education and Training

1. National Weather Service - A factor which may limit the rate of expansion of the Agricultural Weather Service is the availability of trained personnel. In anticipation of this need, the National Weather Service has sponsored special Agricultural Meteorological Institutes in various parts of the country. The objective of this program has been to familiarize meteorologists with agricultural weather relationships. The curriculum includes micrometeorology, microclimatology, or agricultural meteorology, and agricultural sciences.

Although completion of such a course of study does not make an expert agricultural scientist of the meteorologist, it does provide him with a clear picture of the problems of agriculture and their relation to weather phenomena, and facilitates the exchange of ideas between meteorologists and agriculturalists. The agricultural education and training program will, therefore, continue to support these Institutes as an instrument for training agricultural forecasters.

2. USDA - The Science and Education Administration of the USDA proposes to create, with State participation, a small corps of extension meteorologists who will develop and demonstrate more effective applications of meteorological data to agricultural production operations. These programs will be implemented through existing mechanisms involving for the most part, the County Agent System.

The extension meteorologist will also be responsible for identifying requirements, evaluating both the quality of the information and its application and recommendations for program changes for thos agricultural areas which are served.

As part of this program, USDA will develop programs to bring extension personnel into more direct working relationships with appropriate NWS personnel to jointly conduct programs to provide farmers with the best available weather and weather-related information. NWS will be responsible for developing weather information Extention will be responsible for applying this information to models developed by Agricultural and Cooperative Research. The output of these models will be interpreted by Extension specialists and made available to users.

3. Farmers and Ranchers - Expanding NWS technology (eg. MOS products) has allowed the agricultural forecasters to improve the reliability and applicability of the agricultural forecasts. Improvements in the agricultural services products, improved accessibility and applicability will require a user education and training program. Informing the farmer and rancher of these improvements and how he may benefit from them is as critical as the improvements themselves. USDA-SEA Extention will, through its county agents, take the lead in this aspect of the National Program.

f. Supporting Research and Special Studies

One of the major problems in agricultural weather service is the lack of systematic methods for determining precisely the impacts of differing weather conditions on agricultural operations and production. When weather conditions are extreme or severe the impact becomes rather obvious, but the effect of abnormal weather conditions that are smaller than that which threatens disastrous consequences cannot be appraised reliably. This frequently results in a situation in which weather information is either not used at all or perhaps even worse, misinterpreted. One of the major improvements in agricultural weather services that should be attempted lies in the area of application of the information in day-to-day planning, decision-making and in the execution of agricultural operations.

1. USDA - Supporting research by the Department of Agriculture will emphasize the relationships of weather and climate to plants, animals, and the environment. Major efforts will continue on how these factors affect various insect species, including development and behavior, and on better uses of beneficial insects. Research is seeking to determine the relationship between weather and climate and such factors as crop hardiness, quality, productivity and drought resistance. The Department of Agriculture is directing a national research program on plant disease epidemiology and forecasting in which extensive use is made of micrometeorological data observed at plant level. A pilot project is being developed to monitor moisture levels in representative soils under alternative crop and management systems. The objective here is to predict soil behavior (yield, erodibility, and other behavioral aspects) under varying conditions of climate, land use, and weather. A major research program is being conducted on environmental influences on livestock. These studies relate weather conditions to animal development and health to provide guidance on shelter and housing requirements and feed and nutrition requirements under varying weather condtions.

Developmental work to adapt the results of these research efforts for routine operational application must be given high priority. This will require cooperation between, research and extension personnel and NOAA.

2. National Weather Service - An expanded technical studies program will be undertaken jointly by NWS and the Agricultural Experiment Stations located at state universities located in California, Northeastern, Middle Atlantic, North Central, Central, Northwestern, and Rocky Mountain areas. The objective of this effort:

- To combine successfully, knowledge obtained through interrelated studies and investigations made in the fields of agriculture, meteorology, climatology and hydrology;
- To apply this knowledge to the solution of practical agricultural problems;
- To adapt general forecasts to the specific needs of agriculture;
- To provide agricultural forecasts of increased accuracy and of longer projection into the future;

In an effort to support this activity, the NWS has and will continue to develop objective methods for forecasting specific agricultural weather elements. At present, agricultural weather guidance is produced daily for Indiana and Michigan. Included in this guidance are forecasts of air and soil temperatures, relative humidity, precipitation amount, and dew and frost. The existing program will be expanded to include several other areas where specialized weather guidance is needed. A comptuerized system will produce daily forecasts of agricultural weather elements, and transmit this guidance to the appropriate National Weather Service Offices.

7. Implementation of the Plan

In order to effect the expansions and improvements in the Agricultural Weather Service that will achieve the goal and objectives of this plan, the Department of Commerce and Agriculture will need to adopt a carefully designed program for implementing the various components of the service system. These components consist of (1) facilities -- the weather measurement or observing stations; (2) equipment -- the sensing instruments and data handling devices; and (3) personnel -- the meteorologists and agricultural weather extension specialists needed to man new offices or augment the staff of existing offices. Unfortunately it is not possible to specify a priori the final structure or content of the total system. This difficulty results from the fact that the program has to be cost-effective. A thorough analysis of the ultimate payoff to the Nation in the form of economic benefits or ammenities that would result from an agricultural weather service that satisfies all identified requirements has never been carried out. Indeed, it is not at all clear that such an analysis is even possible with presently available data and information. Consequently the implementation of the plan will occur in the form of the set of pilot experiments designed to test the total concept of improved agricultural weather services described in this plan, i.e., more and better agricultural weather measurements, more readily accessible and timely information, new advisories and bulletins tailored for direct application, etc. These pilot programs will be implemented on a state-by-state basis in which costs and benefits will be carefully monitored and analyzed. The results from these programs, involving perhaps as many as ten states will be fed back into a total system design. At that time specifications and resource requirements for the total agricultural weather service program can be set forth.

UNITED STATES DEPARTMENT OF AGRICULTURE
SCIENCE AND EDUCATION ADMINISTRATION

Office of the Deputy Director for
Federal Research
Washington, D.C. 20250

JUL 20 1976

Subject: Transmittal of the Draft of the Federal Plan for a National Agricultural Weather Service

To: Harold Scott, Chief
Agricultural Services Branch
National Weather Service, NOAA
Silver Spring, Maryland

Enclosed is a rough draft of the subject plan. As a result of your conversations with Dr. Hershfield, we have reduced the text of your version considerably with the goal of making the plan more operationally explicit than it is now. Please review this plan carefully and add any additional services or plans for services that NOAA is to provide to agriculture.

When the modified plan is returned with your input, we can establish a USDA committee to meet with their NOAA counterpart to prepare this document for review by other government agencies.

T. W. Edminster

T. W. EDMINSTER
Deputy Director
Federal Research

Enclosure

Draft 5/15/78

FOREWORD

This Federal Plan for a National Agricultural Weather Service focuses on the need for providing specialized weather services to farmers and other agribusiness interests. It is one in a series of plans prepared by the Federal Coordinator for Meteorological Services and Supporting Research to describe present and planned services for specialized user groups. It is a joint plan prepared by representatives from the Department of Agriculture and the Department of Commerce, and is in response to Bureau of the Budget Circular A-62, with the advice and assistance of the Interdepartmental Committee for Meteorological Services.

This Plan is directed toward improving and expanding agricultural weather services and includes the agricultural applications of climatology. It makes maximum use of the observational networks and the data processing and disseminating facilities of the Basic Meteorological Service of the Department of Commerce.

INTRODUCTION

Weather is the pivotal point for many phases of the agricultural production cycle. Most decisions in agricultural planning must take into account past, present, and expected weather conditions. Weather support to agriculture should be designed to contribute to user decisions which will minimize losses resulting from adverse weather conditions and improve the yield and quality of agricultural products through effective planting, cultivation, processing and marketing procedures, and control of pests and diseases. In addition, it should provide meteorological support for policy decisions concerning national and global agricultural production.

Implementation of the Plan for Agricultural Weather Service reported in this document will aid the application, on a nationwide basis, of improved techniques of weather interpretation and dissemination--many of which have been tested in the field--to the day-to-day problems of the users. The planned improved weather service will feature: (1) collection, analysis, and interpretation of weather data pertinent to optimum planning of the allocation of agricultural land, labor, and capital; (2) technical studies in agriculture-weather relationships at one or more Federal and State Agricultural Experiment Stations in each major agricultural area aimed at future improvements in weather service; (3) agricultural weather forecasts designed to support specific types and phases of farm operations, including processing and marketing decisions; and (4) rapid and efficient dissemination of forecasts, warnings, outlooks, and advisories.

ROLE OF FEDERAL AGENCIES

To gain the most efficient and effective Agricultural Weather Service, two Federal agencies, the Department of Agriculture and the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce, prepared this Federal Plan.

Basic weather services for all public interests are provided by the Department of Commerce's NOAA. Two agencies within NOAA are currently carrying out support programs for agriculture: the National Weather Service (NWS) and the Environmental Data Service (EDS). The NWS manages and operates the agricultural weather forecasting and advisory program. In the operation of the program, weather forecast formats and techniques tailored in some areas to meet the needs of farmers are devised by NWS' agricultural meteorologists and utilized daily through mass dissemination outlets. Activities of NWS related to agriculture include Environmental Study Service Centers (ESSC) and Advisory Agricultural Meteorologists (AAM). Activities of EDS include the Center for Climatic and Environmental Assessment (CCEA) and the cooperative Weather and Crop Reporting and Advisory Service carried on by the agricultural meteorologists and the agricultural statisticians of the Department of Agriculture's Statistical Reporting Service. This office monitors cumulative weather developments, summarizes State Weather and Crop Bulletins, and publishes the National Weekly Weather and Crop Bulletin. It also provides data in cooperation with the Department of Agriculture for planning and operating national programs dealing with the production of food fiber. The National Weather and Crop Bulletin features a World Agricultural Weather Watch section. This is a survey of the cumulative weather conditions in the main crop-producing countries with commentary on the effects on harvests.

The NWS and EDS both conduct research directed toward the forecasting and climatological needs of agriculture, in some cases cooperating on the same project.

The role of the Department of Agriculture in the National Agricultural Weather Service program is twofold: supporting research and cooperative release of agricultural weather information for farming and other agribusiness interests. A sustained research program by the Department of Agriculture for determining the specific effects of weather elements upon all facets of agricultural production contributes basic knowledge necessary to identify the needs for specialized agricultural weather forecasting techniques. The Department of Agriculture along with State Agricultural Experiment Stations and Cooperative Extension Services also plays a very important role with NOAA in issuing joint releases which recommend ways and means of increasing yield or minimizing crop losses anticipated from pending weather conditions.

1.0 USER REQUIREMENTS AND POTENTIAL SERVICE VALUE

To design an Agricultural Weather Service, it is necessary to determine the user requirements in terms of specific information which is needed to support equally specific operational decisions.

An Agricultural Weather Service must be completely integrated and fully specialized in terms of its three basic components: observations, climatological analyses, and forecasts. Observations must supply the correct measurements and reports of the appropriate atmospheric elements and phenomena; climatology must organize, summarize, and present the data in proper form for planning, designing, and highlighting the forecast problem: and forecasts must supply the real-time probability functions or expectancies of the elements and phenomena required for strategy selection.

To obtain optimum value from this weather information, individual farmers or agricultural groups may seek the advice of private consulting meteorologists. Such experts in the application of meteorological information to specific operational problems can tailor NWS information to specific individual needs and can often increase profitability of operations to such a degree that the cost of their service will be repaid many times. A list of qualified consultants can be obtained from the American Meteorological Society, 45 Beacon Street, Boston, Mass. 02108.

Because user requirements are continually changing, agricultural user groups, that is, farmers and other agriculture program decision makers, must be queried on a regular basis as to their requirements for meteorological information.

In developing this Plan, an attempt was made to divide the total user population into a number of categories and subcategories. The external user population which comprises the agribusiness complex was first divided into three major categories, namely: I - Agricultural Producers; II - Supporting Services; and III - Processors, Shippers, and marketers. Requirements of each of these categories were then examined independently.

The resultant categories and description of operational requirements (Appendix: Tables 1-5) provide a general view of the requirements of agricultural users. The activities listed represent examples and are not intended to encompass all weather-sensitive operations. Specific descriptions of quantitative limits are approximations in many cases.

The requirements of Category I users are generally associated with a limited geographical area and reflect the needs of specific weather-sensitive agricultural operations appropriate to the season, the product, and the stage of development. Table 1A presents a sampling of such requirements which are peculiar to the needs of certain agricultural producers; in the interest of brevity, these have been limited to five agricultural products and not all weather-sensitive operations are shown.

From similar analysis of a more extensive spectrum of products, table 1B was constructed representing a first-order consolidation of production activities, parameters, and periods of interest which are common to a number of farming operations. Such consolidation provides a basis for determination of service products which will, to the extent feasible, serve the operational needs of multiple users.

Category II users comprise that portion of the agribusiness complex which directly supports the operations of the Category I producers. Examples of these are commercial pest control services, farm management services, and Federal and State extension services. One of the more weather-sensitive groups is the commercial crop sprayers and dusters. Table 2 presents the summarized requirements of these users for operations incident to both aerial and ground application.

Cagegory III users include processors, shippers, and marketers who provide the final link in the production chain to the ultimate consumer.

Table 3 presents the summarized operaional requirements of these users in similar fashion.

The foregoing summarizations were further consolidated as presented in Table 4 which outlines the minimum generalized product requirements to meet the most significant and basic operational needs of each major user category.

Weather-influenced agricultural decisions cover a broad spectrum of time. The agribusiness community could benefit greatly from weather forecasts covering the entire season. However, any appreciable forecasting skill that improves on long-term climatological expectancies is limited by present knowledge to a period of about a month in advance. Therefore, the operational requirements expressed in Tables 1 through 3 have been restricted to those which can be reasonably well met by presently feasible forecasts. Climatological information, showing the probability of weather conditions based on past history, provides a useful input into many operational decisions and is the only useful weather information for planning decisions that have implementation more than a month in the future. Table 5 gives some examples of planning requirements for which decisions can be improved by the application of climatological information.

Appendix Table 6 indicates the type of meteorological information which msut be made available for the production of such plant disease forecasts. Similar meteorological and hydrological inputs have been developed which contribute to the forecasting of additional significant indirect effects of weather on agricultural operations other than disease control. Specific advisories are valuable, for example, in such operations as irrigation, harvesting, blossom thinning, defoliation, and application of special herbicides.

2.0 PRESENT NOAA AGRICULTURAL WEATHER SERVICE PROGRAM

Agriculture's need for specialized forecasts and advisories has been clearly established.

2.1 Products and Services

The Agricultural Weather Service now attempts to provide advanced and effective integration of available meteorological talent with that of Federal and State specialists of Colleges of Agriculture, Agricultural Experiment Stations, Extension Services, and other components of the Federal and State Departments of Agriculture to provide users with both short- and long-range planning information and certain specialized services. To accomplish this objective, the Agricultural Weather Service has developed three closely integrated programs involving forecasting and interpretation, data collection and dissemination, and more general climatological planning support; these programs are described below.

2.1.1 Forecasting and Interpretation Program

The forecasting and interpretation functions required for effective service are performed at two facilities. Forecasts are prepared at a NWS Forecast Office staffed with at least one forecaster designated as an agricultural focal point. Interpretation of forecasts and other weather issuances is the responsibility of the Agricultural Weather Service Office or the Environmental Studies Service Center one or more of which are located near an Experiment Station in each service area. These Offices are listed in Table I.

Weather Service Forecast Offices (WSFO) preparing agricultural forecasts are concerned primarily with the generation of general agricultural forecasts covering a 2-day period (with an outlook for the third, fourth, and fifth days). These forecasts are issued twice daily--in the early morning and in the evening--to provide guidance in managing farm operations on a day-to-day basis.

Agricultural Weather Service Facility Locations

Weather Service Offices having agricultural forecast responsibility:

Albuquerque, N.M.
Atlanta, Ga.
Birmingham, Ala.
Bismarck, N.D.
Boise, Idaho
Brownsville, Tex.
Columbia, S.C.
Grand Rapids,Mich.
Detroit, Mich.
Indianapolis, Ind.
Fort Worth, Tex.
Fresno, Calif.
Jackson, Miss.
Little Rock, Ark.
Louisville, Ky.
Lubbock, Tex.
Memphis, Tenn.
Milwaukee, Wisc.
New Orleans, La.
Omaha, Neb.
Philadelphia, Pa.
Portland, Oreg.
Riverside, Calif.
Ruskin, Fla.
Sacramento, Calif.
Sioux Falls, S.C.
Washington, D.C.
Wenatchee, Wash.
Yakima, Wash.

Agricultural Weather Service Offices (Advisory-Extension):

ESSC, Auburn; Auburn, Ala.
ESSC, Stoneville; Stoneville, Miss.
ESSC, College Station, Tex.
ESSC, Lafayette, Ind.
AWSO, Corvallis, Ore.
AWSO, Kiberly, Idaho
AWSO, Lubbock, Tex.
AWSO, New Brunswick, N.J.
AWSO, Portageville, Mo.
AWSO, Kearneysville, W.Va.

2.1.2 Data Collection Program

One of the prime requirements of the Agricultural Weather Service is an adequate network of observing stations to provide data on elements that characterize the physical environment of the agricultural area. Parameters may include some or all of the following:

*Temperature and humidity of the air
*Air-motion
*Sunshine and radiation
*Soil temperature and moisture
*Hydrometeors

To provide such data, the NWS utilizes a number of cooperative observing stations in representative agricultural areas and within or near various crops or enterprises. Currently, there are 20 to 40 such stations in each State being served by the Agricultural Weather Service. As far as practicable, the stations used are already integral parts of the national climatological and hydrological networks. Where necessary to obtain pertinent data, additional sites are established for the specific purpose of supporting the Agricultural Weather Service. Instruments are furnished and serviced by the NWS. In most cases the observers, as part of a corps of nearly 13,000 private citizens, serve without pay. Normally, daily measurements are made of the maximum/minimum and current air and soil temperatures, amounts of rainfall, and sometimes, evaporation and dew duration.

Routine agricultural weather observations from these cooperative stations are taken in the early morning and are telephoned to the nearest Weather Service Office where they are placed on a teleprinter network for dissemination. These observations provide an essential supplement to the NWS' overall observing network, aiding the WSFO preparing agricultural forecasts and the ESSC or the Weather Service Office for Agriculture in the preparation and verification of forecasts and advisories, and in the evaluation of the accuracy of previous products. These observations also provide valuable data for preparing agriculture-meteorology technical studies and for developing improved forecasting techniques. Summarizations are made by the agricultural meteorologist for these purposes and are available to other interested local users on request.

As part of the overall agricultural weather observing program and in cooperation with agricultural scientists at Federal and State Experiment Stations, Extension Services, colleges, and universities, observations of the microenvironment are also obtained at each ESSC or Weather Service Office for Agriculture for use in technical studies associated with agriculture-meteorology relationships. Parameters being observed include:

- Total radiation
- Net radiation
- Evaporation (Evapotranspiration)
- Temperature of air
- Temperature of soil
- Temperature of foilage
- Temperature of crop level
- Temperature of soil-air interface
- Soil moisture
- Composition of the air in the biosphere
- Duration and amount or dew and/or leaf wetness
- Wind (crop level and standard)
- Rainfall (micronetwork)
- Humidity

Automated agricultural weather stations have been developed and are in use at Lafayette, Indiana and at Lexington, Kentucky. Data from these stations are received directly at the WSO/Ag and the Agricultural College Computer Center for use in agricultural weather summaries and advisories.

2.1.3 Dissemination Program

Beneficial results from any Agricultural Weather Service cannot be realized unless a direct link with the user is available by which weather forecasts and advisories, farm bulletins, weather observational data, and allied information can be effectively distributed. As in other weather services, the products reach the users in a variety of ways, the most common being through the news media and agricultural agencies (for example, county agents). To improve the collection and dissemination of agricultural weather information, the NWS employs the telephone, continuous NOAA Weather Radio braodcasts, radio and a group of special, local and agricultural-area, agricultural weather networks, teletypewriter networks, including the NOAA Weather Wire Service. The operation of these networks insures that vital weather information is made available for dissemination by the mass media with the least possible delay.

Each of the existing networks connects the area Weather Service Office preparing agricultural forecasts and the Weather Service Office(s) for Agriculture and ESSC's with the news media and other agricultural disseminators in the respective service area. The networks generally operate 24 hours a day throughout the year. Routine collection and distribution schedules are arranged for and monitored by the Weather Service Forecast Office for each network.

Communication facilities in the expanding Agricultural Weather Service are provided by the National Weather Service which pays the charges of the basic circuit. In turn, mass dissemination media and other interested subscribers lease receiving machines from the appropriate communications company and pay local connection charges.

In addition to forecasts, advisories, and observations of specific interest to agriculture, these circuits also carry flood warnings, river forecasts, and weather information aimed at the general public such as warnings of severe weather.

3.0 PLAN FOR AN IMPROVED AGRICULTURAL WEATHER SERVICE

3.1 Products and Services

There is widespread recognition of the benefits resulting from the improved level of service now being provided in selected areas. As a result, there is increasing demand for broadening the service program's scope to meet established user requirements.

3.2 Service System Configuration

Improvement of the Agricultural Weather Service is based primarily on implementation of a phased program to provide coverage to all currently unserviced areas; and replacing those areas having Agricultural Weather Service Offices serving one State or a part of a State, with an Environmental Study Service Center serving two or more States. This action consitutes the major change necessary in the present system configuration to meet the specific requirements of agricultural user groups. This expansion will require forecasters at selected National Weather Forecast Office locations to provide forecast service in the associated agricultural areas. These forecasters will perform functions and generate products as described in Section 2.1.1. As the program is implemented and to the extent feasible, the specialized, long-established Fruit-Frost Weather Service will be integrated into the regular Agricultural Weather Service program.

Concurrently, Environmental Study Service Centers will be established to provide the agricultural users with the specialized interpretive products which are most pertinent to agricultural operations. Specifically, the agricultural meteorologists at each ESSC will have responsibility for:

- Issuing daily advisories which describe how the recent and forecast weather events will affect current agricultural operations.
- Cooperating with Federal and State Agricultural Specialists on technical studies relevant to agriculture-weather relationships and on the application of these relationships to the improvement of operational Agricultural Weather Service.
- Issuing joint releases on agricultural interpretation of the daily and other meteorological forecasts in cooperation with State and Federal research and extension personnel.
- Cooperating with the MIC of the Weather Service Forecast Office in promoting the maximum distribution of weather data, forecasts, and outlooks by the various means of mass news dissemination.
- Acquainting the forecasters with the requirements of agriculture for weather data and forecasts.
- Coordinating with National Weather Service Forecast Offices within the area, and with Field Aides in the establishment of a network of representative agricultural weather observing stations.
- Maintaining liaison with mass news disseminators and with all segments of agriculture in the area.
- Cooperating with River Forecast Centers and River District Offices to obtain maximum application of hydrologic services to agricultural operations and to prevent duplication of effort.
- Evaluating data from the Extension-NWS agricultural weather networks.

The ability to provide accurate and meaningful forecasts for an agricultural area depends to a large extent on the availability of weather observations from sites which are representative of conditions in those areas. Special agricultural observing sites will be established as required to augment the existing national climatological and hydrological network, and arrangements will be made for daily reporting by telephone toll calls from the cooperative observers to the nearest Weather Service Office. The numbers of sites required will be a function of size of the area, topography, types of agriculture, and weather variability.

Finally, the communications required for the collection of agricultural observations and the dissemination of agricultural forecasts, advisories, summaries, and related information to mass media and other interested subscribers will be mainly by the NOAA Weather Wire Service. Continuous radio transmission facilities provided for under other National Weather Service programs will be used where they exist to supplement mass media dissemination as required.

4.0 SUPPORTING PROGRAMS

4.1 Research and Development Program, Department of Commerce

Except for special agricultural observing, the functions of the ESSC are interpretive in nature; that is, every product is intended for and oriented toward direct use by agricultural user groups. The effective use of these Agricultural Weather Service products by any user in making operational and planning decisions depends, to a large extent, on accuracy in predicting future weather conditions. Present forecast techniques leave much to be desired in this regard. To insure effective accomplishment of the Service program, an extensive agriculture weather research and development effort is essential. The objectives of such efforts to:

* Successfully combine knowledge obtained through interrelated studies and investigations made in the fields of agriculture, meteorology, climatology, and hydrology.

- Apply this knowledge to the solution of practical agricultural problems.
- Adapt general forecasts to the specific needs of agriculture.
- Provide forecasts of increased accuracy and of longer projection into the future.

In addition to the broadscale motion of the atmosphere and its accompanying weather systems, local variations are particularly important in agriculture. Local variations of insolation; precipitation (rain, snow, sleet, hail) dew; air, soil, and foliage temperature; humidity; wind; and the presence or absence of low-level inversions, individually or collectively, are frequently the controlling factors in agricultural operations. The improvement in methods of measuring and forecasting these parameters is a valid area for meteorological research. Such research is quite distinct from the technical applications studies that the agricultural meteorologist conducts in cooperation with agricultural specialists as a part of the operational program.

Meteorological research programs in support of the Agricultural Weather Service should include improved means of describing and forecasting weather through the development of physical models. These models should allow for the prediction of meteorological conditions at the macro-, meso-, and microscale levels. The models should further increase accuracy of temperature and precipitation predictions in the 5-day, 30-day, and seasonal range; aid in improving accuracy of shorter range forecasts of wind, temperature, humidity, and precipitation; as well as the prediction of microscale meteorological phenomena.

Because there are many meteorological elements whose prediction is important to agricultural operations, some initial priority must be assigned to the various problem areas. First priority should be assigned to the forecasting of precipitation, its occurrence, timing, and amount. Next in importance is evaporation, including some means of accurate measurement and forecasting. Other meteorological factors in order of their general importance are: temperature, temperature inversions, wind, and dew. Apendix Table 7 lists specific technique and equipment development projects which should be pursued in support of the general problems of agriculture.

The foregoing list assigns priorities in terms of general overall interest and importance to many areas. In any one area, there may be specialized problems which have a high local priority and are thus worthy of particular emphasis. Examples are listed in Appendix Table 8.

To meet agricultural research and development needs, only a small effort has been carried on over several years that explored the application of new methods to the prediction of freezes and rainfall in agricultural areas. The program outlined in Tables 7 and 8 will expand this effort and will provide techniques for predicting other weather factors such as humidity, local wind patterns, dew, sunshine, and combinations of weather elements which affect particular types of operation.

4.2 Education and Training Program, Department of Commerce

A factor which may limit the rate of expansion of the Agricultural Weather Service is the availability of trained personnel. In anticipation of this need, the National Weather Service in recent years (FY 1961-FY 1971) sponsored special Agricultural Meteorological Institutes at Land Grant Colleges in various parts of the country. The objective of this program was to familiarize meteorologists with agricultural weather relationships. About 10 meteorologists attended each of these Institutes. The curriculum extended over one semester and consisted of courses in micrometeorology, microclimatology, agricultural meteorology, and selected courses in agricultural sciences.

Although completion of such a course of study did not make an expert agricultural scientist of the meteorologist, it did provide him with a clearer picture of the problems of agriculture and their relation to weather phenomena, and facilitates the exchange of ideas between meteorologists and agriculturists. The agricultural education and training program will, therefore, be reestablished to support these Institutes as an instrument for training agricultural forecasters.

Specialized training of a different nature from the one-semester Institute is also required by the prospective agricultural meteorologists and the Meteorological Technicians and Field Aides who will support the agricultural service program. Proper discharge of the important multiple functions of the agricultural meteorologist requires detailed knowledge of crop-weather relationships. The agricultural education and training program will provide the necessary support to insure that prospective agricultural meteorologists receive advanced university training in agricultural meteorology or closely related fields.

Finally, the Meteorological Technicians and Field Aides associated with the Agricultural Weather Service will receive specialized training to insure effective performance. An inservice survey seminar series will be provided for this purpose.

4.3 Research and Development Program, Department of Agriculture

The Department of Agriculture's research programs in support of agricultural weather services include the following:

* Detailed microclimatic studies to determine the interactions between measured meteorological parameters and specific plant, forest, and animal responses.

* Studies of energy budget relationships at the earth's surface as they affect evaporation from soil and water surfaces and transpiration from crops and forest plants, and as they influence animal responses.

* Studies of precipitation-runoff relationships and related meteorological parameters as they relate to the hydrologic responses of agricultural and forested watersheds.

* Detailed research studies on the influence of meteorological parameters upon the incidence of plant and animal pathogens and upon the related epidemiological consequences of such infections.

* Detailed research studies on the influence of meteorological parameters upon the incidence of insect, parasite, and fungus populations and upon the related epidemiological consequences of populations.

* Studies of the relationship of weather parameters to problems of pre- and post-crop harvest, processing, storage, and shipment as they influence the quality of a crop and its use.

* Studies of the relationship of meteorological parameters to the incidence and control of forest and range fires and of such other weather phenomena as frost, hail, wind, and severe storms.

4.4 Extension Program, Department of Agriculture

The Extension Service, a three-way partnership of County, State and Federal personnel, is responsible for educational programs designed to assist farmers in maintaining an adequate supply of food, feed and fiber. The effects of weather are great variables affecting profitable agricultural production. Therefore, an understanding of localized weather conditions is an important tool in agricultural decisionmaking and the formulation of Extension's recommendations to farmers.

Extension's agricultural programs dealing with weather include development of:

- * Agricultural weather networks, in cooperation with the National Weather Service, that will provide localized base and real-time weather data needed for agricultural decisionmaking.
- * Educational programs to provide agricultural leaders and producers with a firm understanding of weather, its effects on agricultural production, and methods to obtain National Weather Service forecasts/warnings/advisories.
- * A system to ascertain from agricultural producers the types of weather-related information they need and a system of feedback to NWS on the types of data needed.
- * Programs to quantify the effects of weather on agriculture such as in insect development, efficient master utilization, harvesting at optimum quality, and spread of diseases.

5.0 IMPLEMENTATION PLAN

A rationale for providing an improved Agricultural Weather Service to agriculture can be based on the assumption that specialized meteorological information allows weather-related agricultural decisions to be made more expeditiously than would otherwise be the case. The importance of these decisions to the farmer, to the agribusiness community, and finally to the nation in terms of a wholesome environment and in terms of adequate food and fiber for the total population varies over wide ranges or levels of social and economic importance. In the final analysis, the goal of an Agricultural Weather Service should be to provide the meteorological information or service needed to assure an efficient agricultural operation in a healthy and viable environment.

Guidelines for establishing priorities for agricultural enterprises which can be classified into two broad areas:

- Those enterprises for which economic returns are only slightly related to associated weather factors or those of such a nature that once the farmer has committed himself, he can do relatively little to affect the outcome.

- Those enterprises for which economic returns are closely related to weather-influenced decisions and operations of the farmer.

The previous Federal Plan for a National Agricultural Weather Service envisioned expansion of the agricultural weather service into only a few States each year. However, with the ESSC concept, expansion into the remaining unserviced areas should be possible in one or two years given an adequate increase in budgeting support.

Expansion of the Agricultural Weather Service program into unserviced areas will be carried out as funds become available. Required new funding for such expansion includes:

	WSFO's	ESSC's	Research	Training	Support
Positions	6	22	1	3	4
Costs	$800K	$1927K	$100K	$251K	$107K

TOTAL	POSITIONS	COSTS
	36	$3185K

The present cooperation between National Weather Service and State Universities, Agricultural Experiment Stations, and Extension Services is making a strong weather impact on agriculture and appears to be the most efficient and economical method of implementing the Agricultural Weather Service. The NOAA components cannot possibly supply all of the interdisciplinary competence found in the Extension,Experiment Station, and University staffs which help agricultural meteorologists and climatologists define weather relationships basic to the planning and operation of agricultural activities. Conversely, the States cannot afford to collect all the data or provide all the services required. With the States paying (or apparently willing to pay) for a proportionate share of the cost, the cooperative approach seems most effective and is the method suggested for any further expansion of the Agricultural Weather Service beyond what is shown in this Plan for the remaining agricultural areas of the country.

In addition Section 302 of the Intergovernmental Cooperation Act of 1968 (P.L. 90-577; 82 Stat. 1102) authorizes Federal agencies to provide, under certain conditions, specialized or technical services to States and local units of government on a reimbursable basis. Specialized agricultural weather services may be provided to a State or political subdivision of the State upon the written request of the chief executive of the policital entity, with the proviso that payment or provision for reimbursement to NOAA will be made by the unit making the request. The NOAA provision could involve assignment of professional personnel, access to all pertinent data analyses and forecasts in national communication channels or the national archives, and assistance with a public information dissemination system. The State could provide expertise in many fields of application (agronomy, horticulture, entomology, pathology, etc.), laboratory facilities and office space, technical and clerical assistance, and local travel. Cost determination will be in accordance with the policy set forth in Bureau of the Budget Circular No. A-25, "User Charges" (September 23, 1959). Rules and regulations permitting Federal agencies to provide specialized or technical services to States and local units of government are promulgated in Bureau of the Budget Circular No. A-97 (August 29, 1960).

Mr. BROWN. We next have a panel on Future Agriculture Weather Operations and Technology. Dr. Jon Bartholic, chairman of the Meteorology Panel of the Agriculture Research Institute; Dr. John Gerber, director of the Institute of Food and Agriculture Service at the University of Florida at Gainesville.

You gentlemen are going to inspire us with a vision of what the future holds if we just do the right things.

You may proceed first, Dr. Bartholic.

STATEMENT OF DR. JON BARTHOLIC, CHAIRMAN, METEOROLOGY PANEL, AGRICULTURE RESEARCH INSTITUTE

Dr. BARTHOLIC. Thank you, Congressman Brown, members of the Agriculture Committee and the Science and Technology Committee. We certainly appreciate this opportunity to discuss this important subject with you.

Today I am representing the Agricultural Research Institute, which has over 100 members, somewhat unique in that its membership is made up of Federal, State, and private organizations.

Specifically, I am chairman of our Ag Meteorology Panel, which has over 50 members from throughout this country.

I would like to also comment that during all of our panel meetings we have had good input and cooperation from the National Weather Services as well as the U.S. Department of Agriculture.

Mr. BROWN. Well, it is easier for me to pick on the Weather Service than it is on you, so I kind of look like I am picking on them more than I should. I know they are cooperative.

Dr. BARTHOLIC. Thank you.

We feel that this is a crucial time for focusing thoughts on agricultural weather and for leadership to emerge for developing a truly effective weather and climate system. We feel, as I am sure this committee does, that American agriculture is particularly stressed at this time because of the cost and expenses of inputs, and yet the relatively low cost of the farm products coming out of that system.

We feel that weather has more impact on farming operations, costs of inputs and the ultimate cost of food to the consumer than any other factor. Yet, with good weather and timely weather information, farmers can react more effectively.

These hearings and the ARI blueprint address what can be done to develop a better weather and climate information system and to aid the farmers. I want to emphasize that point, because much of the ARI blueprint deals with the orientation of the end user. So we are oriented toward aiding on-farm decisionmaking for more effective food and fiber production.

Basically, out of our panel, as we have looked at what is going on around the country, it is clear that in the land grant system, particularly the Agriculture Experiment Stations, and within the Agricultural Research Service of USDA, that a whole array of new and better understanding of the interaction of weather with the biological system, whether it is the crop, the forest, or the animal, are emerging. So a whole array of what we call bioweather-related models are surfacing that, when coupled with weather and climate information, can assist in better decisionmaking at the farm level.

I would like to emphasize that we think both weather and climate are important, as well as the models. The weather is certainly important for knowing what is going to go on in the next few hours or the next few days. But the climate keeps us up to date with the development of that crop or the insect or the disease. So we need both of those types of information. And ultimately, as we see the present and the future, those need to be coupled into a system that—as we have heard from much of the testimony—allows us to better predict disease outbreaks, insect development, irrigation timing, fertilizer application and a whole array of examples that have been provided to this committee.

However, we would like to emphasize that there are additional benefits. The first, of course, is a reduction in the use of chemicals. And second, and we think of equal importance, is that as we use less chemicals and use them more wisely with good weather information, then we can minimize any possible negative impact on the environment.

Also of significance, the panel has found that there are a number of new and exciting technologies that are emerging. And again, you have heard these. You have heard them in earlier testimonies when you talk about information systems, when you meet with some of your other NOAA committees or with NASA. There is a whole array of new technologies that are possible that can have positive impacts on the farming systems. And Dr. Gerber will probably be talking about some of that in the FAST operation next.

But basically the committee has found that this array of possibilities exists, and also can assist in communications, as was just mentioned. And also the advances in microcomputers allow us to do a number of things. One, as was mentioned in the Arizona case with the microcomputers, we are now able to acquire, in real-time, hourly wind, temperature, dew point, soil information from a variety of locations.

The private and State sectors and State governments are helping to implement that system. In the north-central region alone we have over 100 microcomputerized data acquisition systems that have been invested in for over a half million dollars. They are also maintained. We feel that is part of the ultimate Federal/State partnership this is an important resource to the Federal Government as well, and could be involved in many of the Federal programs relative to the implication and use of those. So we think that truly there is a considerable investment on the part of the private and State, and this does need to be tied into a more wholistic total system.

Also, we feel that the communication area is one that is just exploding. Even though we talk about weather radios, we also know that with new TV programs, and also the Kellogg Foundation has recently estimated that 85 percent of our farms will have microcomputers by the end of this decade. USA Today recently ran a survey that showed that 60 percent of the students graduating from high school are computer literate, and 40 percent have hands-on experience. We don't expect any of our graduates from the university level to leave without hands-on and first-hand experience on microcomputers.

So we do think there is a strong compatibility between new technologies, new educational approaches, and a whole array of weather products that can go to the farm either now or in the very near future.

The bottom line is that with timely and detailed weather and climate data, coupled with bioweather models, and new computer and communication technology, a new array of cost- and resource-saving options are possible. A system for optimizing the substitution of information for resources can be developed.

The challenge this committee is facing, as many of us are, is whether or not the Federal, State and private sectors can respond to this opportunity to take advantage of the new technologies and knowledge, and emerge a new weather and climate system.

Clearly, the overwhelming response we have seen—and as the hearings have shown—is that this system needs to evolve, and needs to evolve now.

The ARI blueprint is basically a systems approach that would indicate that we need the Federal, the State and the private inputs. We do feel that we need strong designation of a lead department and we have talked in the blueprint about what we call planning and coordinating functions.

As we have looked at what has occurred, and met with agencies over the past several years, it becomes clear to us that many of the present agencies that exist to serve the ultimate end user, the farmer, emerged over the past several decades. So what we find is that we have got a number of parallel components. Many of those individual ones you have talked to today or mentioned during the hearings—our ARI panel indicated as many as nearly 20 independent agencies or organizations from which the end user, the farmer, would ultimately need some inputs. So we feel that it is important that all these components be tied together in a system, and that there be one agency or department that has major responsibility for that.

We do feel that the private role is very important, but that for this segment to evolve, the niche of the private sector must be clearly delineated and a procedure to define the approach for getting weather and climate and bioweather models to that private sector must be fully advanced.

Basically, a structure needs to evolve so that research, weather and climate data in various organizational capacities can mesh in an optimal way. We feel that the objective of the ARI blueprint is to integrate existing agricultural weather activities into one dynamic, coordinated system, with the goal of maintaining the competitive superiority of U.S. agriculture.

We feel that this will require, one, a mandated weather and climate system with strong leadership coming from one Federal department, yet with considerable grass roots input. We feel clearly that because there hasn't been a designated lead agency it has been difficult for anyone to know who should really take the leadership, or who would really take the blame if the system does not evolve. And we do think that it is very essential that it have grass roots input from farmer organizations, maybe individual farmers, so that the system does stay oriented toward the end user.

Second, as part of the system evolution, planning and coordinating efforts, our panel has found that there is a tremendous amount of activity going on—as has been indicated at these hearings—at the State and regional levels. There is a role for the private and public sector, but we need an effective planning mechanism for that to go on. Without the mandated programs, despite some herculean and very exciting activities at the State level, as we know, any one partner can pull out of that and destroy what is already going on to develop a stronger system.

So basically, the planning and coordinating boards at the State level would allow for considerable autonomy since each State is very different. The National Weather Services serves those areas quite differently. The private sector has evolved differently in different States, and the farming systems are so different in each State that we think that the planning and coordinating boards will allow for each State to have some autonomy, and yet structure up through a regional and ultimately to the Federal level for a totally more effective system.

I think that this is a very important part, because we talk about a lot of meetings going on. We talk about plans that have been evolving over the last 10 to 12 years, and yet they haven't crystallized. And I think it is essential that we implement a system that allows for that crystallization.

Mr. Chairman, I would like to have the ARI blueprint entered into the record since I won't discuss it in any more detail at this time.

Mr. **Brown**. Without objection, it will be made a part of the record at this point.

[The material referred to follows:]

AN APPROACH TO A FLEXIBLE AGRICULTURAL AND FORESTRY WEATHER AND CLIMATE SYSTEM

Executive Summary

OBJECTIVE: To integrate existing agricultural weather activities into one dynamic, coordinated system with the goal of maintaining the competitive superiority of U.S. agriculture.

JUSTIFICATION:

-The technological base for weather forecasting, information and end product usage has changed considerably over the years as have the components required to provide agricultural weather services. However, the system to support these activities has not evolved accordingly.

-U.S. agriculture is fighting to remain competitive in light of increased production costs, subsidized foreign production and urbanization of agricultural land. Accurately prepared and readily available weather information is necessary for a farmer's profitability and help insure supremacy in agricultural productivity.

-A shift in federal government, state and private industry roles is taking place. The relationship between private, state and federal entities involved in weather activities must be clarified to facilitate more efficient use of limited financial resources. Without this cooperation, agriculture stands to lose a needed service due to funding instability and general program disorganization.

SUMMARY OF PROPOSED SYSTEM: A new weather and climate system organized at state, regional and federal levels would be heavily user oriented. Each level would have a planning and coordination (P/C) board (made up of existing components), and focus on the following systemwide goals:

- organized planning and program coordination
- effective communication and sharing of information
- coordination of forecasts, agricultural advisories based on bio-weather interaction computer models and information networks
- user education and input
- development of a dissemination network, data base, financial support needed for the system and a matching fund system between federal, state or private sources

SUMMARY OF LEVELS: The *state/local level* would be nearly autonomous to maintain the utmost flexibility in planning and coordination based on local need. Goal emphasis would primarily be on user education, user need and input, expansion of general weather information and forecasts, specific agricultural advisories relying extensively on bio-weather interaction computer models, and collection of data for model and archiving purposes at various levels.

The *regional level* would function as a clearinghouse and sifter of data between state and federal levels for most efficient utilization and coordination of similar projects.

The *federal level* would coordinate the various federal government entities in an overall policy framework. Leadership would be provided by the U.S. Department of Agriculture; however, the USDA and National Weather Service would work in conjunction on a joint planning basis. Agencies would receive their funding based on an overall plan developed by the National P/C Task Force, utilizing their normal funding structure. Needs and requirements at this level would also be from state and regional levels. Detailed work plans would be jointly coordinated and developed.

THE NEXT STEPS: Time is of the essence as the FY 1985 budget once again removes funding for agricultural weather services. The most important steps are:

- A legislatively mandated Agricultural and Forestry Weather and Climate *System* must be implemented. This would allow:
  - Establishment of clearer lines of responsibility of the federal government in providing agricultural weather through the legislative process.
  - Establishment of a National Planning/Coordination Task Force to provide further direction on the details and funding requirements of the system to Congress.
- Maintenance of the currently operating National Weather Service programs for agriculture while a coordinated system is being developed.

ACKNOWLEDGEMENT: The ARI Panel on Agricultural Meteorology has given tirelessly toward the development of the concepts incorporated here. Several members have also helped extensively with writing portions of this paper. Their comments and encouragement have been essential.

AN APPROACH TO A FLEXIBLE AGRICULTURAL AND FORESTRY WEATHER AND CLIMATE SYSTEM

GOAL

A weather and climate "system" to aid in keeping U.S. agricultural and forestry producers and supporting industries technically and productively superior.

OBJECTIVE

To develop an effective integrated information system that incorporates the existing activities into one dynamic agricultural weather and climate system oriented to users. The U.S. Department of Agriculture would be the administrative lead department with strong leadership coming from the Cooperative Extension Service within USDA.

JUSTIFICATION

The technological base for weather forecasting, dissemination, and usage is changing, along with the components required for agricultural weather. These components now include satellite data, new communication via satellite, and new forecasting information from both a broad and now-casting perspective. The use of microprocessors and microcomputers is changing the entire area of verification and real time weather data acquisition. Better relationships between weather and biological systems are evolving which can provide more quantitative agricultural advisories. Therefore, real time weather and climate information is now coming from a different route than in the past, and when coupled with new dissemination possibilities, there needs to be a revolution in how this area is approached. Additionally, private and public roles are being re-examined and need to be put in perspective.

If the food production industry of the country is to stay competitive, the United States must have the most advanced weather forecasting, interpretation and dissemination system available. As many other countries have already provided some organization in this area, the competitiveness of U.S. agricultural production will be further jeopardized if we do not develop our own abilities. This, in turn, will affect our overall balance of trade. A new weather and climate system for agriculture will help insure our supremacy in agricultural productivity.

BLUEPRINT

The overall blueprint for the new system would consist of three levels of organization: national, regional, and state/local. Each level would have much horizontal extent.

Elements and Structure of the Levels

National: The national level would include the following U.S. Department of Commerce entities: National Weather Service (NWS), National Climate Program Office (NCPO), and the National Environmental, Satellite, Data, and Information Services (NESDIS). Also included would be the following U.S. Department of Agriculture entities: Cooperative Extension Service (CES), Cooperative State Research Service (CSRS), Agriculture Research Service (ARS), Economic Reporting Service (ERS), Statistical Reporting Service (SRS), Forest Service (FS), Animal and Plant Health Inspection Service (APHIS), and World Agricultural Outlook Board.

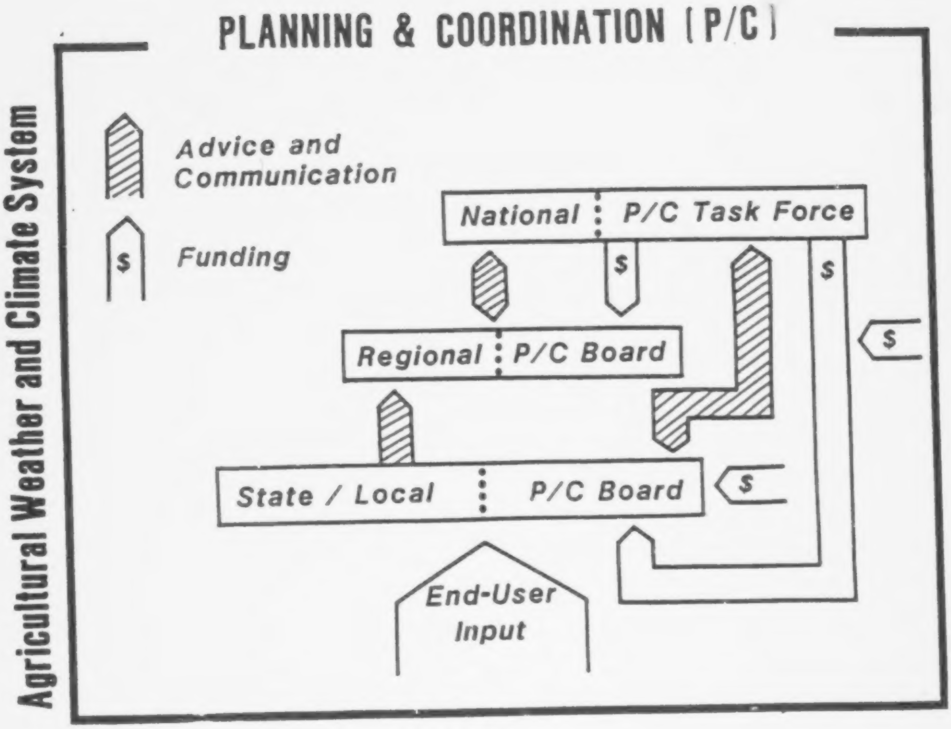
Other organizations at the national level, such as the Agency for International Development and the Central Intelligence Agency, also use forecasting and climate products.

Clearly, all these functions need to be tightly coordinated and tied together so that planning functions can be done in concert. In addition, input from regional and state levels would be needed. The planning and coordination (P/C) for the weather and climate system is outlined simply in Figure 1. The National P/C Task Force would be composed of the various agencies along with representatives from the regional and state levels. The U.S. Department of Agriculture would take leadership, in conjunction with other federal agencies, in developing joint planning on both an annual and a five-year basis. The dollar support needed would also be developed. The majority of the dollar support would be concentrated within the Department of Agriculture. However, the other agencies would use their normal funding structure for dollar requests based on the overall plan developed by the National P/C Task Force. Detailed work plans would be jointly developed and coordinated.

Regional: These activities would involve the regional offices of the Agricultural Experiment Station and Cooperative Extension Service Directors' Associations, the National Weather Service, the National Climate Program, and the USDA/CSRS Regional Research Project. There are also numerous other federal and private activities organized at the regional level.

The Regional P/C Board would consist of Cooperative Extension and Agricultural Experiment Station Directors' regional association representatives, NWS, USDA and representatives from private, state and user level organizations.

Figure 1.


PLANNING & COORDINATION (P/C)
Agricultural Weather and Climate System
Advice and Communication
$
Funding
National : P/C Task Force
$
$
$
Regional : P/C Board
State / Local : P/C Board
$
End-User Input

State/Local: The state and local level would include: the Cooperative Extension Service, Agriculture Experiment Stations, National Weather Service offices, State Climatologists, private consulting firms, cooperatives, newspapers, radio stations, and agricultural weather/farm weather networks. The State/Local P/C Board would, thus, include the above plus state government and private industry representation.

Funding

Funding would be coordinated at the federal level for greater efficiency. A stable program, mandated by Congress, is an absolutely essential part of the activity to effect efficient planning. Core funding would need to be increased in phases to a new level which would then be incremented annually to keep up with inflation.

Coordination at the regional level results in benefits to the region, and the state and federal levels as well. A matching between federal and state or private dollars would be needed.

At the state/local level, state and private groups would realize the most benefit, however, a federal tie is necessary for developing data standards and quality control for shared climate data for access to information acquired by state and private concerns. This data and information is crucial for many federal programs and responsibilities. At this level some dollar match of federal to state and private would be planned.

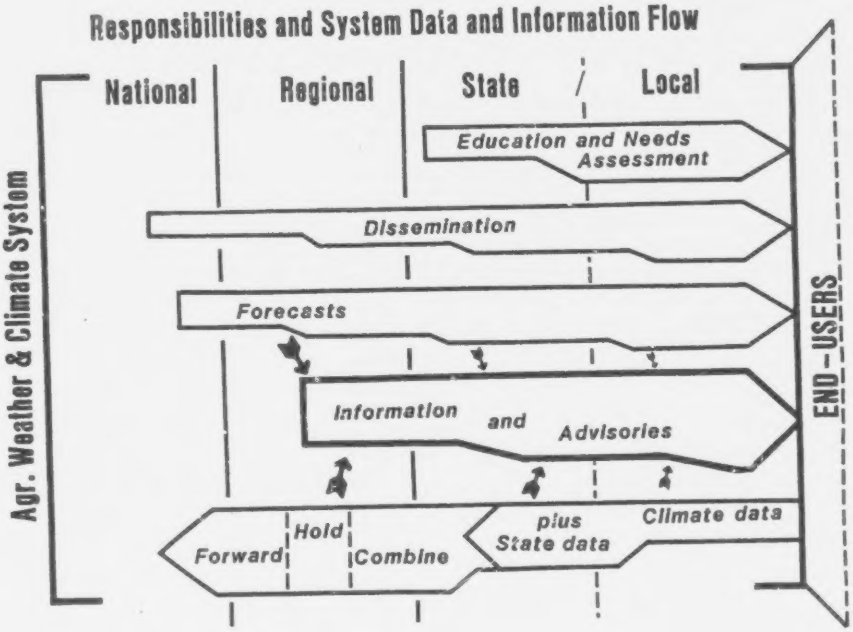
Planning/Coordinating Process

The system will need to have an organized planning structure that allows for maximum flexibility at the regional and state levels. Each Regional P/C Board will have the opportunity to set up their regional activity as they see fit. This might include one regional office or multiple offices within the region which are coordinated. Also, at the state level, considerable autonomy in program development by the State/Local P/C will be needed. In fact, some states may desire to have multiple centers of effort. A key, however, within the regions and states, will be coordinated programs by the Boards with well-defined responsibilities (among state, private and federal entities), effective communications and well-developed protocols for sharing data and information among the various parties.

Figure 2 shows the responsibilities and data and informational flows within the system. The emphasis is on the end-user. At the state and local level, both education on the use of weather products and needs for weather and other related information will be assessed. The dissemination network would flow from the national to the regional level and from the region to the states (some direct linkage from national to state would be necessary). The state and local organizations would then have responsibility for expanding the dissemination tree with much of the dissemination being done from the local level to the end-user. Forecasts would largely be originated at the national level. These, however, would be expanded at the regional, state and local levels to become more time and location specific. Much of the

Figure 2.

Responsibilities and System Data and Information Flow


National
Regional
State / Local
Education and Needs Assessment
Dissemination
Forecasts
Information and Advisories
Forward
Hold
Combine
plus State data
Climate data
Agr. Weather & Climate System
END-USERS

information and advisory content would originate at the regional level with inputs coming from forecasts and climate data bases. This weather and climate information will be input into sophisticated computer programs that couple the weather data with plant and animal system models to develop specific management options and economic trade-off advisories to aid end-users in decision making. Most of the ag advisory content (IPM information, irrigation timing, animal and plant stress indexes etc.) would be developed at the state and local levels. In many ways, this would be the largest and most important part of the total system from the end-users' perspective.

With new data acquisition techniques, including microcomputers, data originates at the local level for verification of forecasts, building climate data bases and aiding decision-making at all levels. These data will be consolidated, quality-controlled and expanded at the state level and then combined with that from other states at the regional level where essential parts will be archived. Data required at the national level would be forwarded from the region.

Conclusion

End-users are clamoring for better, more complete and easily accessible weather/climate forecasts and information advisories. They know the data are needed to improve production efficiency to stay competitive in world markets. New computer, satellite sensor and communication technologies offer revolutionary potentials for developing new weather products and advisories, and communicating them to individual end-users. Unfortunately, the present weather agency components have no way of coping with the needs or incorporating the new technologies effectively. Thus, a new weather and climate system has been proposed to meet the needs and incorporate new technologies and players. The system proposed incorporates all the essential elements. It is oriented to the end-users' needs with the largest inputs from the local/state level, but it also addresses regional and, ultimately, national needs. The planning and coordinating functions occur through boards at the state/local and regional levels and the national task force to assure that the systems approach is accomplished. A legislative mandate and additional core funding are essential elements with the funding being used to augment the system and for matching support to bond the system together.

This conceptual plan is workable and effectively incorporates the private and public sectors. We cannot rely any longer on the present compartmentalized components for weather and climate information. There is a strong and compelling need to move now toward a new weather and climate system for agriculture, forestry and natural resources.

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If you have questions or would like more information, contact:

Dr. Edwin A. Crosby, Jr., President
Agricultural Research Institute (ARI)
9650 Rockville Pike
Bethasda, Maryland 20814
(301) 530-7122

or

ARI Agricultural Meteorology Study Panel
c/o Dr. Jon Bartholic, Chair
Department of Resource Development
323 Natural Resources Building
Michigan State University
East Lansing, Michigan 48824
(517) 355-3421

Dr. BARTHOLIC. Thank you.

In conclusion, in many ways this is the teachable moment: the time for action. Clearly, there is an overwhelming need for a better weather and climate system. Many research results and technologies are now available for use in this system. The ARI plan provides a conceptual framework for a systems approach to Federal, State and private inputs for optimal use and stabilization of the many creative new approaches that are being implemented on an experimental basis throughout this country. Individual Federal, State, and private components are presently stalled. They require the leadership and direction that can evolve from these hearings and subsequent actions. The result will be a more competitive food system with expanding exports, more profitable farms and better conservation of our resources and better protection of our environment.

Mr. Chairman, we appreciate this opportunity to present these thoughts to you and the committees.

[The prepared statement and biographical sketch of Dr. Bartholic follows:]

OVERSIGHT HEARINGS ON AGRICULTURAL WEATHER
June 27-28, 1984

Jon Bartholic, Chairperson
Agricultural Research Institute (ARI) Ag Meteorology Panel

This is a crucial time for focusing thoughts on agricultural weather and for leadership to emerge for development of a truly effective weather and climate system for American agriculture and forestry. We in the Agricultural Research Institute (ARI), which has one hundred federal, state and private member organizations, and you, are well aware that farmers are severely stressed due to the need for expensive inputs in a time of weak prices.

Weather has more impact on farming operations, cost of operations and the subsequent cost of food to consumers than any other factor. With good and timely weather information, however, farmers can react and plan more effectively.

These hearings, and the ARI Blueprint, address what can be done to develop a better weather and climate information system to aid on-farm decision-making for more efficient food and fiber production.

Background: The Agricultural Experiment Stations in the land-grant universities, and the Agricultural Research Service (ARS) of USDA are obtaining a much better understanding of how weather interacts with crop, forest and animal systems. An array of quantitative relationships (bio-weather models) now exist which utilize weather and climate data to aid in better decision-making for pest management, irrigation timing, fertilizer application, etc. An additional benefit is that better information leads to reduced use of chemicals with a subsequent decrease both in costs to farmers and possible negative impact on the environment.

Also of significance are a number of new technologies which allow for a broad array of new weather products. Satellite-mounted sensors have allowed development of new, now-casting weather products. With satellite communication and microcomputers for analysis, information in a much more time- and space-specific orientation for farm-level decision-making is now possible. These give farmers, in considerable detail, information about present weather conditions (areas of rainfall, detailed wind information, dew conditions, onset of freezing temperatures etc.) and about what will be occurring in the next few hours. This information can impact all spraying, haying and other field operations.

The bottom line is that with timely and detailed weather and climate data, coupled with bio-weather models and new computer and communication technologies, a new array of cost- and resource-saving options are possible. A system for optimizing the substitution of information for resources can be deployed.

The challenge is whether or not the federal, state and private sectors can respond now to take advantage of new knowledge and technology so a new weather and climate system can evolve. The overwhelming response we've seen for this hearing and the enthusiasm that has been generated throughout the country for new agricultural weather products, clearly indicates that now is the time for action.

The ARI Blueprint: Any system that evolves needs federal input and structural assistance, with meaningful guidance from the state-level; i.e., from farmers, farm and forestry organizations, state government and the land-grant system. The private role is very important. For that segment to evolve, however, the niche of the private sector must be clearly delineated and a procedure defined to provide them with necessary weather and climate data and bio-weather models. Basically, a structure needs to evolve so research, weather and climate data, and various organizational capabilities can mesh in an optimal way. The objective is to integrate existing agricultural weather activities into one dynamic, coordinated system with the goal of maintaining the competitive superiority of U.S. agriculture. This will require:

1. A mandated weather and climate system, with strong leadership coming from one federal department, yet with considerable grass-roots input.
2. As part of the system evolution, planning and coordinating efforts (boards) at the state, the regional and ultimately the federal level, will be needed. The dynamics of the system are such that each state needs the flexibility to evolve an interaction of federal, state and private inputs appropriate to that state. Many states are presently evolving some form of planning and

coordinating effort which they are finding to be very effective. However, that planning and coordinating function needs to be formalalized. Ultimately, support for enhancing and tying present system components together will be required. The ARI Blueprint discusses this system and provides more detail.

In many ways, this is the teachable moment--the time for action--the time for statesmanship and leadership to be exercised so efforts can move ahead. Clearly there is an overwhelming need for a better weather and climate system. Many research results and technologies are now available for use in this system. The ARI plan provides a conceptual framework for a systems approach of federal, state and private inputs and for optimal use and stabilization of the many creative new approaches that are being implemented on an experimental basis throughout this country. Individual federal, state and private components are presently stalled. They require the leadership and direction that can evolve from these hearings and subsequent actions. The major positive steps outlined in these hearings, if met, will lead to more profitable agricultural and forestry industries. The result will be more competitive food exports, more profitable farms, better conservation of our resources and better protection of the environment. A better weather and climate system for agriculture and forestry is needed NOW.

MICHIGAN STATE UNIVERSITY

DEPARTMENT OF RESOURCE DEVELOPMENT
NATURAL RESOURCES BUILDING

EAST LANSING · MICHIGAN · 48824

Biographical Sketch for Dr. Jon F. Bartholic

Dr. Bartholic obtained his B.S. degree from Michigan State University and his Ph.D. from South Dakota State University. He then spent two years in the military where he served as a Research Officer at Fort Huachuca, Arizona. The following four years were spent with the U.S. Department of Agriculture in the lower Rio Grande Valley of Texas on research involving citrus, vegetables and pastures. He was in Florida from 1971-78 conducting research on evaluating the effects of the environment on plant productivity. Specifically, as a climatologist, his efforts involved water loss and freeze protection research. Remotely sensed information from aircraft and satellites was used to aid in better understanding the water and temperature situations over Florida. In December, 1978, he assumed responsibilities as Assistant Director of the Michigan Agricultural Experiment Station and became Associate Director in December, 1981. His primary responsibilities were to provide leadership and coordination in project development, regional research allocations and the funding and administration of interdisciplinary research programs. In March, 1983 he became Chairperson, Department of Resource Development; Coordinator, Center for Remote Sensing and Director, Institute of Water Research, Michigan State University.

Mr. **Brown**. That last line was the magic word, Dr. Bartholic. We need to stress that at every opportunity.

The subcommittee is going to have to recess for a few minutes to vote on that bill that the bells announced. It is an increase in the debt limit, and we want the country to go more deeply into debt, so we will have to go vote on that. But we will be back in about 10 minutes. And we hope that you will be able to remain with us.

Dr. **Bartholic**. We certainly will.

[Brief recess.]

Mr. **Brown**. The subcommittee will come to order.

I apologize for the delay, and I hope we won't have any more in the immediate future.

Dr. Gerber, you may proceed with your statement.

STATEMENT OF DR. JOHN GERBER, DIRECTOR, INSTITUTE OF FOOD AND AGRICULTURE SERVICE, UNIVERSITY OF FLORIDA, GAINESVILLE

Dr. **Gerber**. Thank you, Congressman Brown.

I appreciate the opportunity to appear before this committee. I have, I believe, placed before you a photo album that contains some photographs of some satellite imagery that has been developed. We are currently using that and disseminating that to users through a not-for-profit corporation. So I want to talk in sort of a dual capacity, as a representative from the university and also as a person involved with that organization as well.

I will try to be brief and abbreviate part of my testimony.

Few human endeavors are as affected as much by weather as agriculture and forestry and fisheries. And when I talk about agricultural weather I am going to use that generically to refer to weather in support of agriculture, forestry and fisheries.

Ironically, the Federal Government has not felt compelled to supply basic food and fiber producers or fishermen with quality weather service tailored to fit their specific needs. Instead, the USDA and other agencies of Government have supplied economic disaster relief in the form of low interest loans or grants to producers afflicted by floods, droughts, freezes, hail, hurricanes, blizzards, tornadoes, or other weather-induced calamities.

The Corps of Engineers and the Bureau of Reclamation have constructed facilities to reduce losses from such calamities, even though cost/benefit ratios have been low. Now, the same Government is reluctant, however, to supply weather services which cost much less and have higher cost/benefit ratios. I don't think the reasons for this are necessarily clear. To some extent it is because weather is viewed as an act of God, and therefore unavoidable. On the other hand, beach conditions, ski conditions, race track conditions and weather for athletic contests are observed in forecasts and reported because of high public interest.

There seems to be an attitude in Government that agriculture, forestry, and fisheries are special interests and should depend upon private, professional meteorolgists or corporations for weather services. This attitude may derive in part because of a feeling that this is getting Government off the backs of producers, and also that the private sector has the right to profit by providing services to producers of food and fiber.

Even more curious to me and to the farmers that I deal with is the Federal establishment's reluctance to supply weather service to agriculture, but eagerness to supply market services, research service, animal health service, and other such services.

A small group of professionals in the land grant universities and in the National Weather Services have helped maintain some weather services for agriculture that have been beneficial to producers. I won't go into those. I believe we have heard about those in the last couple of days, except I will say that much of the funding and leadership for this has come from State legislatures and from universities.

The situation and the need for weather service has become so desperate that a few not-for-profit companies, such as the one that I referred to and the one that Dr. Hauser described, have been established to provide producers with that weather information that for-profit companies have not been aggressively seeking, perhaps because they did not perceive how they could profitably provide such service.

An additional tragedy is that producers' taxes have helped fund significant improvements in the science of meteorology, remote sensing, communications, and computing. These improvements are not benefiting producers because their Government appears to be insensitive to their needs for weather information to contain or reduce costs, losses, and risks.

I believe that we can do something to change this now, because computers, both large and small, remote sensing, and high-speed, low-cost data communications provide the necessary ingredients for an agricultural weather system that can provide needed information in an intelligible format. Color graphic displays of remotely sensed satellite and radar data can be our ideal mechanisms for communicating weather information to users. These nearly real-time systems provide an immediate forecast for the next few hours, information for local conditions, and access to weather forecasts, observation, and information.

There is a need to tie the forecast to observed occurrences to meet special local needs, and to add local data which relates these conditions to the needs of producers. Research scientists have identified dew point temperatures, winds, temperature of the biologically active surface, solar and net radiation, and soil moisture as critically important elements in agricultural production, and the need to study and characterize these conditions for annual and seasonal trends, to estimate the likelihood of occurrences and to select areas adapted for favorable production.

If you will allow me, I would like to use a personal experience. During the past 4 years there have been three severe freezes in Florida. There are questions today in the minds of producers about a changing trend in the minimum temperatures which are occurring in Florida. There follows the question of who should determine if it is getting colder in Florida during the winter months, who pays for this determination, and who benefits from it?

Over the past 4 years the production of round oranges has dropped from approximately 200 million boxes to 100 million boxes.

In one county alone, the losses due to last year's cold weather will decline from 30 million boxes to approximately 1 million boxes. This results in the loss of thousands of jobs.

The cold weather occurred on Christmas eve, and many producers did not receive warnings of the impending cold weather in time to reschedule Christmas vacations and alert crews. Forecasts would not have prevented cold weather, and many producers have only limited means to deal with it. But if one assumes that an improved forecast would have resulted in 1 percent reduction in losses, this equates to a million boxes of oranges, perhaps $5 million annually over the next 4 to 5 years. If losses could have been reduced by 10 percent, this is $50 million, and this does not include loss of trees or jobs.

Furthermore, I would like to point out, Florida has better agricultural service from the National Weather Services than most of the Nation, and cold weather is only one form of weather-induced loss. Rains which wash away pest-control sprays or nutritional sprays are also losses because effectiveness is reduced and reapplication may be required.

Both satellite and radar data provide information about the location and movement of cold weather, clouds and rain on a nearly continuous basis. Producers must depend upon television graphics for this information, which may be presented as a fleeting glance tailored for a generalized rather than a specialized audience.

Even though the National Weather Services has information of great importance to producers, there is not an effective or an affordable way for a producer to obtain the information in a timely manner. Nevertheless, the National Weather Services is encouraged to save about $200 thousand annually in Florida by discontinuing the fruit frost forecasting services. The funds for this service must be annually inserted into the National Weather Services's budget by the Congress.

There is a philosophy that the service should be provided for a fee. Even if one accepts this hypothesis, it leaves unanswered the question of who will provide startup funds to organize and institute such a service? How can it be determined if the services can be marketed in such a way as to commensurately exploit not only existing technology, but develop the technology that is needed for the future? And how will an orderly transfer occur?

Instead, there is continuing erosion of services because continuing fund restoration only to last year's level produces losses in real dollars, losses in morale, and failure to exploit new technology aggressively.

The Institute of Food and Agricultural Sciences (that I am a part of at the University of Florida), with support from NASA and cooperation from the National Weather Services, helped develop a system for using satellite data on critically cold nights, and that is the information you have before you. We have gone from that to using that approach with a private not-for-profit company called Florida Agricultural Service and Technology to make that information available to users over telephones, using their small microcomputers. And it takes about 1½ minutes to obtain one of those maps.

But of equal concern, I now learn that the National Weather Services' satellite that we have been using, GOES/East is almost to become nonfunctional. That means that we are going to have to use one satellite that currently is designated GOES/West, and there is no money for a new satellite until 1986.

The point I want to make is that if the private sector is to involve itself in providing services, it can't really tolerate these sorts of discontinuities. And it is sort of a disgrace. I felt sorry for my friend Dick Hallgren, to represent the country that invented satellites and be left with maybe one for the next decade. And that goes beyond the agricultural needs. That impacts every place.

So really, the support for the National Weather Services to provide that kind of basic data, even for agricultural weather, needs to be critically examined. I know that is beyond the range of this committee, but it is nonetheless a national concern.

Mr. **Brown**. There are two committees involved in this hearing, and I think the other committee is——

Dr. **Gerber**. I stand corrected. You are right.

But it appears to me that there is a serious deficiency in understanding the importance of remotely sensed weather data for agriculture, forestry and fisheries. Clearly it will never be practical to install and communicate with hundreds or thousands of local automated agricultural weather stations needed to provide detailed local weather important to producers. Satellite data, in sufficient resolution, with some added capabilities and supported by the present observational and forecasting information from the National Weather Services, could provide a much-improved agricultural weather service.

Present satellites provide about 4-mile resolution of temperatures every 30 minutes. While clouds obscure the surface and atmospheric components change temperature calibrations, a system of temperature and cloud data every 4 miles and every 30 minutes exceeds anything else available. With proper instrumentation packages on future satellites, resolution can be increased, surface temperatures measured beneath clouds, radar rainfall measurements incorporated, and specialized inferences on surface humidity, wind, solar radiation, and soil moisture made. With appropriate research and development, an improved operating agricultural weather observational and forecast system could be a reality in the near future. These data can be communicated to producers over phone lines and displayed graphically on small microcomputers.

I believe that a first step in achieving these objectives is to adopt a plan similar to the blueprint developed by the Agricultural Research Institute's panel on agricultural meteorology. My reasons are that:

One, it assigns responsibility for agricultural weather for producers to one department within the Federal Government with a clearly mandated responsibility.

Two, there is a provision for the basic information, such as that that I alluded to from the satellite and other sources, that is necessary to have such a system.

Three, it provides a provision for a basic level of funding to ensure that agricultural weather service will not only be provided on a continuing basis, but will be upgraded to avail producers of the newest developments in science and technology.

Four, it should provide provision for research and development funds for agricultural weather by designating this as an appropriate area of research within the current research and development funding system of the Federal Government. And this, I think, should include development of systems to remotely sense and effectively communicate and display those weather elements important to agriculture, forestry and fisheries.

Five, it requires initiation of an educational program in the Land Grants System to educate producers on use of this information to reduce losses, risks and contain costs.

Six, there is identification of users as those outside the Federal Government who need agricultural weather information. And I believe this is especially important because government at all levels tends to identify as users only those constituents who are members of the departments or agencies that they relate to.

Seven, there should be a determination of the role private industry can play by development of a prototype to provide weather services and information for a fee commensurate with the benefits and adequate to fund these services.

Finally, I have been involved with the establishment of a not-for-profit company called Florida Agricultural Services and Technology to provide services to agricultural producers that build upon the capabilities of the University of Florida and the National Weather Services through added value and the ability to communicate with producers. But I want to stress that this does not eliminate the need for the National Weather Services' current program. In fact, it requires additional support.

While there is interest in and acceptance of FAST, there is no obvious method of funding such organizations, nor are there mechanisms within Government to provide resources that can lead to an orderly transfer of certain agricultural weather services, activities, and produce enhancements to adequately meet the weather service needs of agriculture, forestry and fisheries for the producers' production of food, feed, and fiber.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Gerber follows:]

HEARINGS ON NATIONAL AGRICULTURE WEATHER OPERATIONS

Thursday, June 28, 1984

held by

House Agriculture Committee's Subcommittee on Department Operations,
Research, and Foreign Agriculture

and

House Science and Technology Committee's Subcommittee on Natural Resources,
Agricultural Research, and Environment

Testimony By

John F. Gerber
Director, IFAS Grants Office
Institute of Food and Agricultural Services
and
Professor, Climatology, Department of Fruit Crops
University of Florida

JACK FELLOWS AND HONORABLE GEORGE E. BROWN, JR.

I am Dr. John F. Gerber, from the University of Florida. I have been professionally involved in agricultural weather since 1956 and at the University of Florida since 1960 in a faculty and an administration role. I have participated in a number of studies to evaluate the need for weather services for agriculture and forestry. I appreciate the opportunity to appear before this joint committee. I will refer to agricultural weather service as a generic term as weather services to support agriculture, forestry and fisheries.

°THE NEED FOR AGRICULTURAL WEATHER SERVICE

Few human endeavors are effected as much by weather as agriculture, forestry, and fisheries. The need for adequate agricultural weather service has been adequately documented in numerous studies by reliable sources, both inside and outside, of government. Ironically, the US Federal Government has not felt compelled to supply basic food and fiber producers or fishermen with quality weather service, tailored to fit their specific needs. Instead, the USDA and other agencies of government have supplied economic disaster relief in the form of low interest loans or grants to producers afflicted by floods, drought, freezes, hail, hurricanes, blizzards, tornadoes or other weather induced calamities.

The US Army Corp of Engineers and the Bureau of Reclamation have constructed facilities to reduce losses from such calamities, even though cost benefit ratios have often been low. This same government is reluctant however, to supply weather services which cost much less and have much higher cost benefit ratios. The reasons for this curious state of affairs are not obvious. To some extent, weather is viewed as an Act of God, and therefore unavoidable. On the other hand, beach conditions, ski conditions, racetrack conditions, and weather for athletic contests, are observed, forecasted, and reported because of high public interest. There is an attitude in government that agriculture, forestry, and fisheries are special interests and should depend upon private professional meteorologists or corporations for weather services. This attitude may derive in part from the feeling that this is getting government "off the backs" of producers and that the private sector has the right to profit by providing services to producers of food and fiber.

Even more curious to producers is the federal establishment's reluctance to supply weather service to agriculture, but eagerness to supply market services, research service, extension service, animal health service, economic research service, soil conservation service, etc.

A small group of professionals in the land grant universities and in the National Weather Service have helped maintain some weather services for agriculture that are beneficial to producers. These professionals within the land grant university have not been well supported by the national research establishment, by funding from research and development agencies. In the National Weather Service the professionals have, in my opinion, been penalized. Much of the support for agricultural weather service, as it currently exists, comes from state government. These efforts have played a significant role in the development of horticulture, integrated pest management, air pollution, protection of crops, erosion control, equipment design, irrigation, and drainage.

The situation and the need for weather services has become so desperate that a few not-for-profit companies have been established to provide producers with weather information that for-profit companies have not been aggressively seeking, perhaps because they did not perceive how they could profitably provide such service.

As with all human efforts, what ought to be done and what will be done is different. Perception and ignorance play major roles. Agricultural weather professionals have worked hard to educate policy makers about legitimate needs, but unfortunately this effort keeps being obliterated by policies to reduce government services. An additional tragedy is that producers taxes have helped fund significant improvement in the science of meteorology, remote sensing, communications and computing. These improvements are not benefiting producers because government appears to be insensitive to their needs for weather information to contain or reduce costs, losses, and risks.

°WHAT CAN BE DONE TO CHANGE THE PRESENT SITUATION?

Computers, large and small, remote sensing, and high speed, low cost data communication provide the necessary ingredients for an agricultural weather system which can provide needed information in an intelligible format. Color graphic displays of remotely sensed satellite and radar data, on low cost, generalized microcomputers, provides an ideal mechanism for communicating weather information to users. These nearly real time data systems provide an immediate forecast for the next few hours, information for local conditions and access to weather forecasts, observation and information. There is a need to tie the forecast to observed occurrences to meet special local needs and to add local data which relates these conditions to the needs of producers. Research scientists have identified dewpoint temperature, winds, temperature of the biologically active surface, solar and net radiation and soil moisture as critically important elements in agricultural production, and the need to study and characterize these conditions for annual and seasonal trends (climatology) to estimate the likelihoods of occurrences and to select areas adapted for favorable production.

•LOSSES FROM WEATHER

If you will allow me, I would like to use a personal experience. During the past four years there have been three severe freezes in Florida. There are questions today in the minds of producers about a changing trend in the minimum temperatures which are occurring in Florida. There follows the questions, who should determine if it is getting colder in Florida during the winter months, who pays for this determination, and who benefits from it? Over the past four years, the production of round oranges has dropped in Florida from approximately 200,000,00 boxes to 100,000,00 boxes. In one county alone, the production, due to last years cold weather, will decline from about 30,000,00 boxes to approximately 1,000,000 boxes. This will result in the loss of thousands of jobs. The cold weather occurred on Christmas Eve and many producers did not receive warning of the impending cold weather in time to reschedule Christmas vacations and alert crews. Forecasts would not have prevented cold weather and many producers have only very limited means to deal with cold weather. If one assumes that an improved forecast would have resulted in 1% reduction in losses, this equates to a million boxes of oranges; perhaps $5 million annually for each of the next 4 to 5 years. If losses could have been reduced 10%, this equates to $50 million dollars. This does not include loss of trees or jobs. Furthermore, Florida has better agricultural service from the National Weather Service than most of the nation. Cold weather is only one form of weather induced loss. Rains which wash away pest control sprays or nutritional sprays are also losses because effectiveness is reduced and reapplication may be required.

Both satellite and radar data provide information about the location and movement of cold weather, clouds and rain on a nearly continuous basis. Producers must depend upon television graphics for this information which may be presented as a fleeting glance tailored for a generalized rather than a specialized audience. Even though the National Weather Service has information of great importance to producers, there is not an effective or affordable way for a producer to obtain the information in a timely manner. Nevertheless, the National Weather Service is encouraged to save approximately $200,000 annually in Florida by discontinuing the Fruit Frost Forecasting. The funds for continuing this service must be annually inserted into the National Weather Service's budget by the Congress. There is a philosophy that the service should be provided for a fee. Even if one accepts this hypothesis, it leaves unanswered the question of who will provide start-up funds to organize and institute such services, how can it be determined if the services can be marketed in such a way as to commensurately exploit not only existing technology, but also develop the technology that is needed for the future and how will an orderly transfer occur? Instead there is continuing erosion of services in Florida because continuing fund restoration only to last years level produce losses in real dollars, losses of morale, and failure to aggressively exploit new technology.

°TECHNOLOGICAL DEVELOPMENTS

The Institute of Food and Agricultural Sciences of the University of Florida, with support from NASA and cooperation with the National Weather Service, developed a system to use thermal data from the GOES/East satellite to observe and display temperature data on cold nights in Florida. These data have great utility not only on critically cold nights but also to spot and track rain clouds, fronts and hurricanes. The same techniques have been adapted to radar and textual data from the National Weather Service. However, there is no provision to provide these data directly to producers beyond the use of media or the Cooperative Extension Service. It is my perception that the National Weather Service has interest in exploiting and expanding these techniques, but are discouraged from doing so by lack of funds and by the removal of Agricultural and Fire weather from their budget requests.

It appears that there is as a serious deficiency in understanding the importance of remotely sensed weather data for agriculture, forestry and fisheries. Clearly it will never be practical to install and communicate with hundreds or thousands of local, automated agricultural weather stations needed to provide detailed local weather important to producers. Satellite data, in sufficient resolution with some added capabilities, and supported by the present observational and forecasting information from the National Weather Service, could provide a much improved agricultural weather service. Present satellites provide about four mile resolution of temperatures every 30 minutes. While clouds obscure the surface and atmospheric components change temperature calibrations, a system of temperature and cloud data every four miles and every 30 minutes exceeds anything else available. With proper instrumentation packages on future satellites, resolution can be increased, surface temperatures measured beneath clouds, radar rainfall measurement incorporated and specialized inferences on surface humidity, winds, solar radiation and soil moisture made. With an appropriate instrumentation and research and development, an improved operating agriculture weather observational and forecase system could be a reality in the near future. These data can be communicated to producers over phone lines and displayed graphically on small microcomputers.

•A PLAN TO IMPROVE AGRICULTURAL WEATHER SERVICE

I believe that a first step in achieving these objectives is to adopt a plan similar to the Blueprint developed by the Agricultural Research Institute's Panel on Agricultural Meteorology entitled, "An Approach to a Flexible Agricultural and Forestry Weather and Climate System". My reasons are that I believe it contains the necessary key features. These are:

1. Assignment of responsibility for agricultural weather for producers to a department within the federal government with a clearly mandated responsibility.
2. Provision of the basic information (forecasts, observations, data and communication) to individuals, organizations, or institutions within the states who will assure that it is adapted to local conditions, and communicated effectively to producers.
3. Provision of a basic level of funding to insure that agricultural weather services will not only be provided on a continuing basis, but will also be upgraded to avail the producer of the newest developments in science and technology.
4. Provision of research and development funds for agricultural weather by designating this as an appropriate area within the current research and development funding system of the federal government. This would include development of systems to remotely sense and effectively communicate and display those weather elements important to agriculture, forestry and fisheries.

5. Initiation of an educational program in the land grant system to educate producers on use of agricultural weather information to reduce losses, risks and contain costs.
6. Identification of users, as those outside the federal government, who need agricultural weather information. This is especially important because governments tend to identify, as users, only those constituents who are members of the federal government departments and agencies.
7. Determination of the role private industry can play by development of a prototype to provide weather services and information for a fee commensurate with the benefits and adequate to fund these services.

Finally, I have been involved with the establishment of a not-for-profit company, Florida Agricultural Services and Technology, Inc. (FAST), to provide services to agricultural producers that build upon the capabilities of the University of Florida and the National Weather Service through added value and the ability to communicate with producers. This does not eliminate the need for the National Weather Service's current programs; in fact, it requires additional support. While there is interest in and acceptance of FAST, there is no obvious method of funding such organizations, nor is there mechanism within government to provide resources that can lead to an orderly transfer of certain agricultural weather services activities and produce enhancements to adequately meet the weather service needs of agricultural, forest, and fishery producers of food, feed, and fiber.

Mr. **Brown**. Thank you, Dr. Gerber.

Dr. Gerber, looking at those satellite image maps that you have there, you indicated that the resolution was about 4 miles?

Dr. **Gerber**. Right.

Mr. **Brown**. And what is the temperature discrimination?

Dr. **Gerber**. Approximately a degree; about 1 degree Fahrenheit. We send to the producer a full range of temperatures and then he can display them on his microcomputer down to the nearest degree.

Now, during cold, clear nights there is little ambiguity. If there are clouds, you obviously can't see through the clouds, but you can see where the tops of thunderstorms are and where convective buildup is occurring.

During the summertime, when there is a lot of humidity in the air, then you have to make a correction for that. But those are technical matters that I think are amenable to solution.

Mr. **Brown**. Oh, I think technological progress can bring about solutions to that fairly readily.

Is that degree of accuracy and resolution adequate for producers, or would they benefit from, say, a 1-mile resolution or less than—I can't see that less than a degree of discrimination would have much effect on it.

Dr. **Gerber**. The temperature discrimination is good enough. All producers would like to be able to localize that to their specific field or production unit, so they would like higher resolution. But I point out that measuring temperatures every 4 miles gives us a temperature grid that is finer than anything we can do any other way in a practical sense.

Mr. **Brown**. Has anyone ever tried to actually ascertain what the variations within a grid might be? That is, say you have a 4-mile area that shows the temperature of 30 °C degrees Centigrade. Has there been any effort to determine what the variation within that 4 miles would be because of varying local conditions?

Dr. **Gerber**. Yes, there have been some efforts to do that, in Michigan and in Pennsylvania, as a part of the project that developed this system. Dr. Bartholic participated and helped to get that project started. He might want to comment on that, because I think he did a bit more work in Michigan than we did, and Florida doesn't have very much difference in elevation. So we can determine the differences that are due to local soil and plant conditions, but those due to elevation aren't very apparent in Florida.

Mr. **Brown**. If you have an area, say, 4 miles square that registers as a certain average temperature, and yet there are extreme elevation differences, that average could conceal a fairly wide range of temperature, I suppose. That is the question I am getting at.

Can you speak to that, Dr. Bartholic?

Dr. **Bartholic**. Yes; depending on the terrain, that is true, and particularly upon the wind conditions. Under windier conditions there is more of a uniformity of temperatures. On a cold radiation freeze night then there can be fairly large differences in temperatures.

But we found that in general farmers have a pretty good concept of where their cold spots are and where their warmer spots are if they have an idea of the general temperature patterns within their region. And particularly they look at that over time, so they get an idea of how rapidly the general temperature is falling, and that allows them to make much more pinpoint decisions about using freeze protection.

Mr. BROWN. But in areas such as the plains area or the Southwest where there aren't these altitude differences and other conditions are more uniform, the average temperature revealed by the satellite imagery would be fairly accurate; am I correct?

Dr. GERBER. Very close to the observed data that we have measured with ground stations that we have been able to locate precisely within one of those areas.

Mr. BROWN. Essentially I am trying in some way to get at whether or not we have validated this against ground truth to see what we are getting.

Dr. GERBER. We have in Florida.

Mr. BROWN. All right, Mr. Roberts, do you have any questions of these gentlemen?

Mr. ROBERTS. Yes, Mr. Chairman.

First, I want to thank you for two very fine statements, very candid statements. Dr. Gerber, I think, probably answered in full my question of the National Weather Services in regard to the budget implications, and what the practical effect of that budget situation has been on the total system.

Dr. Bartholic, you indicated, I think, in your testimony, although I haven't been able to pinpoint it here in the written testimony, that you are working more and more with your producer organizations to develop support for something like the ARI Blueprint.

Could you be a little more specific? What kind of response have you had from the producers' organizations? I am talking about our general farm organizations.

Dr. BARTHOLIC. Yes; I think the Farm Bureau organizations have been quite supportive, and they have a general statement in their policy, the American Farm Bureau does. We have worked with the Cotton Council. We have worked with the American Soybean Association. I have talked to a number of the cattlemen's associations. Certainly the national vegetable organizations have also been supportive of this concept and the need for a more stable, dependable system.

I think they are very concerned, again, about the put and take program that has occurred relative to weather services, and the impact that may be having on the morale. And actually, the inopportunity to build and foster a new system over the past 3 years because of all of those uncertainties. So there has been really a sort of stalemate or a standstill when there is still tremendous opportunity out there.

Mr. ROBERTS. We are in the year of debate or the year of consensus building in regard to agriculture program policy and the writing of a new farm bill. And I know the various commodity organizations show a very keen interest in that, to say the least, and contact members of the full committee almost on a daily basis. It seems to me that this is part of the total package. I would hope such organizations as the National Association of Wheat Growers—get my parochial interest in that regard—that could be fully supportive.

Are they fully aware of the technological capabilities here and the crest of the wave kind of thing that we have been talking about in these hearings, do you think?

Dr. BARTHOLIC. Not fully. I think your examples of those that once they learn what can come from that black box, all of a sudden it is not just something that is nice, it is something that is absolutely essential pertains.

We have picked up through the ARI committee as we have traveled around and as members have given us examples is that once a farmer gets used to better information, it does indeed help him on a dollar and cents basis. So it becomes a very crucial part of their program.

So the more examples they see, the more involved they are with ag weather, and I think from the research standpoint we are better understanding how the weather interacts with that wheat or the other crop systems, so it is the involving area that is moving very rapidly.

But I do find that it takes us some time to explain a number of the new products, a number of the new potentials. But once those are explained, then those groups are very, very supportive. But it is an evolving process.

Mr. ROBERTS. Dr. Gerber, would you care to comment? You made some excellent comments, on-hands comments or testimony in regard to what happened to one county in the past 3 years in terms of the orange growers and that production.

Dr. GERBER. Right.

Mr. ROBERTS. I am not sure that a comprehensive, better-organized system would have prevented the kinds of losses that make the difference between staying in business or not. But you even pointed out that 1 percent of a drop in the loss—well, I'm not saying it right.

Do the Florida orange growers totally support your efforts? Do they realize what is involved here?

Dr. GERBER. Yes; I think they are. They have been dependent upon weather services for a long time. Actually, the weather service that supplies information to them was, when it began in the midthirties, a joint effort between the university and the National Weather Services, and there was joint funding.

There has been support by the industry for this activity. They annually come to town to ensure that it doesn't go away, and they are very concerned about the quality of it and what has happened to it over the past few years because of the problems that you alluded to in maintaining morale and maintaining the quality of service in such an uncertain environment.

Mr. ROBERTS. Well, of course, if they get the right information they can do something about it. I am not sure what we do when on May 5, 2 years ago, we got a hard freeze out in wheat country. Smoke pots don't work. I really don't know what we could do about that.

How are you funding the Florida Agriculture Services and Technology, Inc., your nonprofit company? It is called FAST in your statement. How do we get FAST funding?

Dr. GERBER. Well, that has been one of the most difficult things I have ever tried to do. We have received about half of the equipment as a gift from Control Data Corp., which is about $800,000 worth of equipment. We are obligated to pay for about another million dollars' worth of equipment, some of which we don't have completely installed.

We are dependent upon memberships, and we will also use that equipment for other purposes and try to derive income from other sources other than just from the farm source, because it is going to take a while to develop this kind of a system in that kind of a market, because it is new. Farmers tend to be conservative. They want to make sure that something works before they invest their money in it.

Mr. ROBERTS. Not only that, but as you well know, the farm income situation in this country is such that any add-on or any kind of luxury item, or what they would consider to be a luxury item would be one of the cost factors they would consider.

Well, thank you both for two very fine statements.

Thank you, Mr. Chairman.

Mr. BROWN. Just one more moment, gentlemen.

I meant to inquire about this of Dr. Hallgren, but I forgot to. Maybe one of you gentlemen knows something about it.

I understand that the National Weather Services is going to provide specialized weather services for the Olympics next month in California, and I was interested in how much was going to be spent for that. Do any of you gentlemen happen to have any information?

Dr. GERBER. I don't have any.

Dr. HALLGREN. I do.

Mr. BROWN. Would you care to respond to that?

Dr. HALLGREN. We are doing it on a joint basis with a number of agencies and the private sector involved. And the total cost of the services for that period is about $100,000.

Mr. BROWN. I was hoping you were going to use a much bigger figure so I could castigate you for it. But $100,000 seems innocent enough.

Dr. HALLGREN. It would be very hard for me to see this country hosting the Olympics and not providing both to the participants—you know, that is part of the Olympics. The weather information is necessary for all of the sanctioning of the events, along with all the yachting races, and so forth. It is a tradition that we do it.

You might be interested that I have expanded this so that it is now on an international basis. We have two Canadian—they happen to be French-speaking—meteorologists that have joined the team. Two meteorologists from France, and of course, they are French-speaking, to try to broaden this out. And at the Olympic games in 1988 a similar thing will be done with Canada hosting.

Mr. BROWN. Well, actually, I would commend you for that initiative. You know, why don't you do it for farmers, too? [General laughter.]

Mr. ROBERTS. Would the chairman yield at that point?

Mr. **Brown**. Yes; I will yield.

Mr. **Roberts**. Why would we need weather forecasting in southern California? I thought it never rained there. I thought the weather was always beautiful. [General laughter.]

Mr. **Brown**. Well, we want somebody to testify to the beauty of the weather in southern California.

Mr. **Roberts**. Can we make it rain on the opposition? [General laughter.]

Mr. **Roberts**. Thank you, Mr. Chairman.

Mr. **Brown**. Well, that answers that question.

One additional point, Dr. Gerber and Dr. Bartholic. A number of the problems that exist here with regard to developing the technology that is coming along and enhancing the dissemination of that technology is actually laid on to the National Climate Program Office. And I haven't been satisfied with that. It is one of my great frustrations here that I worked rather hard to get that legislation passed several years ago, and for one reason or another it hasn't been implemented as well as I would like. Which makes you cynical about trying to make legislative change in this great system of ours sometimes.

I wanted to inquire as to what your experience has been with the utility of the National Climate Program Office in terms of involving the user community, particularly agriculture, although they are not limited to agriculture. They are supposed to look at all user communities. But in terms of securing some leadership to achieve some of these changes that we are talking about, have you had any contacts that would indicate the role that they are playing there?

Dr. **Gerber**. I have had some contacts and we have had some support for some of the personnel that were instrumental in helping to develop part of this. I think their biggest limitation that I have experienced with them is not a lack of willingness to cooperate and help, but a limitation on the funding levels that they have that are available to help.

Mr. **Brown**. One of their jobs is supposed to be to look at the integrated funding picture for all of meteorology and the application of climate data, and to make recommendations. I presume that their recommendations have not received a great deal of attention from other offices such as OMB, which is unfortunate in my opinion.

Do you have anything further on that, Dr. Bartholic?

Dr. **Bartholic**. I would just have two brief comments.

One, we have been overall pleased with the activities and their efforts. I think they have put out some demonstration projects that have shown, again, the value of climate and a climate system to farmers.

I would concur with what Dr. Gerber said. My understanding of their program is that it is extremely small.

I think the second area, though, from the panel's standpoint is that again we see a multitude of functions from the end user standpoint. You have got the National Climate Program Office sort of somewhat independent from the National Weather Services, from NESDES, from any other number of functions. So that from the end user's standpoint we now even have somewhat more of a duplication at the regional level with some regional climate centers being somewhat different from other regional activities.

It is not that they are not trying to coordinate. Again, I think it is that because of their mandate they have somewhat different responsibilities. At least it appears that way.

Mr. **Brown**. That would seem to indicate or bear on the point that you made about the need for focusing the leadership role on agricultural weather in some agency that is strictly concerned with agricultural weather. But when you attempt to do that, of course, you are always criticized for adding unnecessarily to the already bureaucratic structure that we have. But somehow there has to be some sort of an optimum solution to this problem, which we will continue to work on.

Mr. Gunderson, do you have any questions?

Mr. **Gunderson**. I have no questions.

Mr. **Brown**. Thank you very much, gentlemen for your help.

Our last panel this morning is from the State of California. They will tell us about their operations in that great State.

Dr. Charles Smallwood, chairman of the ag weather task force at State University at Fresno, and Ms. Gail Damiano, who is director of commodity services for the California Farm Bureau.

We are pleased to have both of you here, and you may proceed with your testimony, Dr. Smallwood.

STATEMENT OF DR. CHARLES M. SMALLWOOD, DEAN, SCHOOL OF AGRICULTURE AND HOME ECONOMICS, CALIFORNIA STATE UNIVERSITY AT FRESNO

Dr. **Smallwood**. Thank you, Mr. Chairman.

In giving this testimony I am representing the California Agricultural Weather Service Task Force. The task force was established last year on the recommendation of the State board of food and agriculture, and appointed by the director of the California Department of Food and Agriculture to study the situation of agricultural weather services in California, and to prepare a set of recommendations on performance and delivery of these services.

I also have the privilege of serving on the State board of food and agriculture.

I would like to submit my printed copy for the record and summarize certain areas of it.

Mr. **Brown**. Dr. Smallwood, without objection, your full statement will appear in the record.

Dr. **Smallwood**. I would certainly like to congratulate the Congress on their foresight to organize this hearing to give an opportunity for farmers and agricultural organizations to express their views on the present operation and future needs of agricultural weather services.

California farmers and ranchers have a great interest in expanding modern agricultural services. This interest is the result of several factors including availability of satellite weather data, new micro-weather data collectors, powerful, low-cost computers, new uses for agricultural weather data, and funding uncertainties for agricultural weather services. Additionally, there is an opportunity before the Congress to provide a bedrock of service that can lead to the development of an effective, integrated information weather system that incorporates modernized, existing activities into one dynamic agricultural and climatic system oriented to the users of this country.

Considering the constantly increasing costs of food production, and all the risks associated with farming and ranching, the effectiveness of weather service is essential for maintaining the productivity and market competitiveness of California agriculture in this country and overseas.

The California Agricultural Weather Task Force was established in 1983, and its goals are, (*a*) to study and evaluate the present situation of agricultural services in California; (*b*) to analyze the present method of monitoring of agricultural weather data and its delivery; (*c*) to evaluate the needs of farmers and ranchers on the type of weather services which would best respond to their needs; and (*d*), prepare a set of propcsals for the development of an effective agricultural weather service system for California agriculture.

Members of the task force represent farmers, agricultural organizations, the University of California, the National Weather Services, and State government. All of these people have been tremendously cooperative on the committee.

Two major tasks have already been completed. First, we have a good understanding of the technical systems presently used in the monitoring of weather data and its delivery to farmers and users. We have found that there are more than 1,200 individual weather stations, 350 of which are automated, located in California and run by many different organizations. Wide variations exist with weather parameters each station will collect, depending upon the intended use of that data.

Unfortunately, we have unnecessary and costly duplication of efforts, simply because there has never been an organized effort to look at what there is out there and how to put together a more cost-effective system.

Second, a survey of several hundred farmers, ranchers, farm advisors, consulting companies and other users of agricultural weather data indicates their most important needs. Preliminary tabulations of the data show that the uses of agricultural weather information are broad. The following shows the frequency of the top eight uses. These are multiple responses from any given farmer. Seventy-seven percent use it for harvesting; 76 percent chemical application; 64 percent frost protection; 64 percent irrigation timing; 63 percent planting; 61 percent pest managenent; 54 percent burning; and 41 percent scheduling of labor activity.

It is interesting to note that two uses rank ahead of frost protection, which has been provided by the Agricultural Weather Service. Harvesting and chemical applications, with frost protection ranked third, followed by irrigation scheduling and pest management. All of these uses of weather information are important, not only in management decisions for efficient farm operations, but in the interest of the safety of neighbors and the general public.

Respondents listed the important weather information parameters that they want as follows:

Seventy-two percent want maximum/minimum temperature information, rain intensity and rain timing; 57 percent wind speed, fruit frost; 47 percent wind direction and burning conditions; 42 percent dew point; 38 percent wind timing, and humidity and average temperature as well as evapotranspiration, 24 percent.

The form in which many users receive their information was also interesting. Ninety-nine percent received their weather information from radio; 94 percent TV also; 62 percent newspaper; 52 percent NOAA weather radio; 51 percent telephone recording; and 5 percent now from computers.

Twenty-two percent of these users stated that in the future they would like their weather information received by computer. With regard to the source of the weather information, 65 percent stated, or at least they perceived, that they currently get their weather information from the National Weather Services, 15 percent from private sources and 6 percent from grower associations, and the rest from other agencies or sources.

In this factfinding process, we discovered that there was no centralized location for climatological information in California. The task force discussed this area, and at a recent meeting the Department of Water Resources volunteered to provide this coordination and help organize this data base. And if we don't accomplish anything else in the committee, we feel that this is certainly a major accomplishment.

Many problems and opportunities are within our control in California. We can develop policies and make administrative decisions to create a workable agricultural weather system. However, there are some areas in which we need decisions of the Congress and the Federal Government.

The major problems at the Federal level which concern us, and you have heard these, are uncertainties in the continuation of funding for the National Weather Services, funding of these services at a level which makes them truly effective, and modernization of agricultural weather services. The solution of these problems is absolutely essential for the development of the type of weather services which would increase their usefulness to growers and members.

We, the California Agricultural Weather Task Force applaud the efforts of the ARI in reviewing agricultural weather, and support ARI's suggestions in general for improvements in the Federal agricultural weather program.

Our efforts in California are consistent with ARI and should contribute to ARI's efforts to improve the Federal program. In fact, our task force has been cited as an example of the State P/C board, or planning and coordination board, discussed in the ARI blueprint.

The uses for agricultural weather forecasts and data are numerous, as has been stated. There is no question that farmers and ranchers benefit from this information. However, the ultimate benefactors are consumers of agricultural products and indeed, the enhancement of national security.

Many different figures have been used on the cost/benefit ratio of agricultural weather. In California alone, it has been cited that $70 million is the cost for citrus. The reason for this varying figure is that it is impossible to accurately determine the actual benefits. I feel it should suffice to say that the benefits are annually in the billions of dollars to this country, and further, the cost/benefit ratio is one of the best in productivity of tax dollars.

One might ask, if this cost/benefit ratio is true, then why doesn't agriculture directly pick up the cost? Our task force doesn't feel that direct support of agricultural weather programs can be equitably accomplished. Even if it could, the cost of billing, collecting, administering, and so forth would probably exceed the cost of agriculture weather programs. In other words, it could not be the cost effective system that already exists. It is unrealistic for us to develop a private system, totally a private system, for agricultural weather service supported by users.

It has to be understood that the backbone to any agricultural weather program, either nationally or locally, is the National Weather Services. Local, regional and national agricultural weather programs and current and potential program improvements for tomorrow are and will be built around the National Weather Services. Therefore, we feel a Federal mandate for funding an agricultural weather program and agricultural weather programs is necessary for the stability of the system. Private weather organizations certainly have a place, as has been demonstrated in testimony here. But the system can never replace the NWS, and in fact will be very dependent on information for their existence.

You have before you a rather unique opportunity in today's society. We often go from one crisis to the next in dealing with problems. We are not, however, currently in a make-or-break situation with agricultural weather, so you can make logical and well founded plans to ensure that a crisis will not be faced tomorrow, and we will effectively plan our agricultural program.

You have seen fit in the last 3 years to reinstate the agricultural weather budget, and we thank you for that support. This is not to say that we don't have more to be done. We strongly recommend three things: first, stability for the agricultural weather program; second, we need to bring current programs up to date with technology that already exists and be better prepared to more readily incorporate new technology into the program; and third, we need coordinated effort between local, State, regional and national programs. This will allow a bedrock of weather information for all agriculture, and foster private development in technology to serve more sophisticated farmers and microclimates that exist, particularly in California.

Effective agricultural weather services are essential, not only to farmers and ranchers, but to the whole society, to people in this country and abroad. We have a challenge in feeding the continuously increasing world population. From the economic point of view, the export of farm commodities is essential to our national economy. We have to reduce risks in the production of food commodities. Policies toward the development of efficient agricultural weather service at the Federal, State and county level and on farms are essential steps for securing future food supplies.

I am confident that the issue of agricultural weather can be effectively dealt with if Federal, State, and local representatives work together. And, speaking for the California Agricultural Weather Task Force, and the California State Board of Food and Agriculture, I can say that we are ready to cooperate in every way that we can to support this cooperative endeavor in the interest of our agricultural industry and the consumer.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Smallwood follows:]

STATEMENT OF

CHARLES M. SMALLWOOD, DEAN
SCHOOL OF AGRICULTURE AND HOME ECONOMICS
CALIFORNIA STATE UNIVERSITY, FRESNO

REPRESENTING
CALIFORNIA AGRICULTURAL WEATHER TASK FORCE

JUNE 28, 1984
WASHINGTON, D. C.

HEARINGS ON
NATIONAL AGRICULTURE WEATHER OPERATIONS

HOUSE AGRICULTURE COMMITTEE:
SUBCOMMITTEE ON DEPARTMENT OPERATIONS, RESEARCH & FOREIGN AGRICULTURE

AND

HOUSE SCIENCE AND TECHNOLOGY COMMITTEE:
SUB-COMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH & ENVIRONMENT

MY NAME IS DR. CHARLES SMALLWOOD, DEAN OF THE SCHOOL OF AGRICULTURE, CALIFORNIA STATE UNIVERSITY IN FRESNO. IN GIVING THIS TESTIMONY I AM REPRESENTING THE CALIFORNIA AGRICULTURAL WEATHER SERVICES TASK FORCE. THE TASK FORCE WAS ESTABLISHED LAST YEAR ON THE RECOMMENDATION OF THE STATE BOARD OF FOOD AND AGRICULTURE AND APPOINTED BY THE DIRECTOR OF THE CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE TO STUDY THE SITUATION OF AGRICULTURAL WEATHER SERVICES IN CALIFORNIA AND TO PREPARE A SET OF RECOMMENDATIONS ON THE PERFORMANCE AND DELIVERY OF THESE SERVICES. I ALSO HAVE THE PRIVILEGE OF SERVING ON THE STATE BOARD OF FOOD AND AGRICULTURE.

I WOULD LIKE TO CONGRATULATE THE U.S. CONGRESS ON THEIR FORESIGHT TO ORGANIZE THIS HEARING, TO GIVE AN OPPORTUNITY TO FARMERS AND TO AGRICULTURAL ORGANIZATIONS TO EXPRESS THEIR VIEWS ON THE PRESENT OPERATION AND FUTURE NEEDS FOR AGRICULTURAL WEATHER SERVICES.

EVEN THOUGH MY COMMENTS ARE SPECIFIC TO AGRICULTURAL WEATHER USES IN CALIFORNIA, THEY ALSO APPLY TO OTHER AREAS IN THE U.S. AND, IN GENERAL, TO EVERY STATE.

CALIFORNIA FARMERS AND RANCHERS HAVE A GREAT INTEREST IN EXPANDING MODERN AGRICULTURAL WEATHER SERVICES. THIS INTEREST IS THE RESULT OF SEVERAL FACTORS INCLUDING AVAILABILITY OF SATELLITE WEATHER DATA, NEW MICRO-WEATHER DATA COLLECTORS, POWERFUL BUT LOW-COST COMPUTERS, NEW USES FOR AGRICULTURAL WEATHER DATA, AND FUNDING UNCERTAINTIES FOR AGRICULTURAL WEATHER SERVICES. ADDITIONALLY, THERE IS AN OPPORTUNITY BEFORE THE CONGRESS TO PROVIDE A BEDROCK OF SERVICE THAT CAN LEAD TO THE DEVELOPMENT OF AN EFFECTIVE INTEGRATED INFORMATION WEATHER SYSTEM THAT INCORPORATES MODERNIZED EXISTING ACTIVITIES INTO ONE DYNAMIC AGRICULTURAL AND CLIMATE SYSTEM ORIENTED TO THE USERS OF THIS COUNTRY.

CONSIDERING THE CONSTANTLY INCREASING COST OF FOOD PRODUCTION, AND ALL THE RISKS ASSOCIATED WITH FARMING AND RANCHING, THE EFFECTIVENESS OF WEATHER SERVICES IS ESSENTIAL FOR MAINTAINING THE PRODUCTIVITY AND MARKET COMPETITIVENESS OF CALIFORNIA AGRICULTURE IN THIS COUNTRY AND OVERSEAS.

THE CALIFORNIA AGRICULTURAL WEATHER TASK FORCE WAS ESTABLISHED IN 1983; ITS GOALS ARE STATED AS: (a) STUDY AND EVALUATE THE PRESENT SITUATION OF AGRICULTURAL SERVICES IN CALIFORNIA; (b) ANALYZE THE PRESENT METHODS OF MONITORING OF AGRICULTURAL WEATHER DATA AND ITS DELIVERY; (c) LVALUATE THE NEEDS OF FARMERS AND RANCHERS ON THE TYPE OF WEATHER SERVICES WHICH WOULD BEST RESPOND TO THEIR NEEDS; AND (d) PREPARE A SET OF PROPOSALS FOR THE DEVELOPMENT OF AN EFFECTIVE AGRICULTURAL WEATHER SERVICE SYSTEM FOR CALIFORNIA AGRICULTURE.

MEMBERS OF THE TASK FORCE REPRESENT FARMERS, AGRICULTURAL ORGANIZATIONS, THE UNIVERSITY OF CALIFORNIA, THE NATIONAL WEATHER SERVICE, AND STATE GOVERNMENT. TWO MAJOR TASKS HAVE ALREADY BEEN COMPLETED. FIRSTLY, WE HAVE A GOOD UNDERSTANDING OF THE TECHNICAL SYSTEMS PRESENTLY USED IN THE MONITORING OF WEATHER DATA AND ITS DELIVERY TO FARMERS AND OTHER USERS. THERE ARE MORE THAN 1,200 INDIVIDUAL WEATHER STATIONS, 350 OF WHICH ARE AUTOMATED, LOCATED IN CALIFORNIA RUN BY MANY DIFFERENT ORGANIZATIONS. WIDE VARIATION EXISTS WITH THE WEATHER PARAMETERS EACH STATION WILL COLLECT DEPENDING UPON THE INTENDED USE OF THE DATA. UNFORTUNATELY, WE HAVE UNNECESSARY AND COSTLY DUPLICATION OF EFFORTS SIMPLY BECAUSE THERE HAS NEVER BEEN AN ORGANIZED EFFORT TO LOOK AT WHAT IS OUT THERE AND HOW TO PUT TOGETHER A MORE COST EFFECTIVE SYSTEM. SECONDLY, A SURVEY OF SEVERAL HUNDRED FARMERS, RANCHERS. FARM ADVISORS, CONSULTING COMPANIES AND OTHER USERS OF AGRICULTURAL WEATHER DATA INDICATES THEIR MOST IMPORTANT NEEDS.

PRELIMINARY TABULATIONS OF THE DATA SHOW THAT THE USES FOR AGRICULTURAL WEATHER INFORMATION IS BROAD. THE FOLLOWING SHOWS THE FREQUENCY OF THE TOP EIGHT USES.

77%	HARVESTING
76%	CHEMICAL APPLICATION
64%	FROST PROTECTION
64%	IRRIGATION TIMING
63%	PLANTING
61%	PEST MANAGEMENT
54%	BURNING
41%	LABOR SCHEDULING

IT IS INTERESTING TO NOTE TWO USES RANKED AHEAD OF FROST PROTECTION, HARVESTING AND CHEMICAL APPLICATIONS WITH FROST PROTECTION RANKED THIRD, FOLLOWED BY IRRIGATION SCHEDULING AND PEST MANAGEMENT. ALL OF THESE USES OF WEATHER INFORMATION ARE IMPORTANT. NOT ONLY IN MAKING MANAGEMENT DECISIONS FOR AN EFFICIENT FARM OPERATION, BUT IN THE INTEREST OF THE SAFETY OF NEIGHBORS AND THE GENERAL PUBLIC.

RESPONDENTS LISTED THE IMPORTANT WEATHER INFORMATION PARAMETERS AS FOLLOWS:

72%	MAXIMUM/MINIMUM TEMPERATURE INFORMATION, RAIN INTENSITY, RAIN TIMING
57%	WINDSPEED, FRUIT FROST
47%	WIND DIRECTION, BURNING CONDITIONS
42%	DEWPOINT
38%	WIND TIMING
36%	RELATIVE HUMIDITY
33%	AVERAGE AIR TEMPERATURE
24%	EVAPOTRANSPIRATION

THE FORM IN WHICH MANY USERS RECEIVE THEIR INFORMATION WAS ALSO INTERESTING.

99%	RADIO
94%	TV
62%	NEWSPAPER
52%	NOAA WEATHER RADIO
51%	TELEPHONE RECORDING
5%	COMPUTER

TWENTY-TWO PERCENT (22%) OF THE USERS STATED THAT IN THE FUTURE THEY WOULD LIKE THEIR WEATHER INFORMATION RECEIVED BY A COMPUTER. WITH REGARD TO THE SOURCE OF THEIR WEATHER INFORMATION, 65% STATED THEY CURRENTLY GET THEIR WEATHER INFORMATION FROM THE NATIONAL WEATHER SERVICE, 15% FROM PRIVATE SOURCES, AND 6% FROM GROWER ASSOCIATIONS AND THE REST FROM OTHER AGENCIES OR SOURCES.

IN THIS FACT-FINDING PROCESS, WE DISCOVERED THAT THERE WAS NO CENTRALIZED LOCATION FOR CLIMATOLOGICAL INFORMATION IN CALIFORNIA. THE TASK FORCE DISCUSSED THIS AREA, AND AT A RECENT MEETING, THE DEPARTMENT OF WATER RESOURCES VOLUNTEERED TO PROVIDE THIS COORDINATION AND HELP ORGANIZE A DATA BASE.

MANY PROBLEMS AND OPPORTUNITIES ARE WITHIN OUR CONTROL IN CALIFORNIA. WE CAN DEVELOP POLICIES AMD MAKE ADMINISTRATIVE DECISIONS TO CREATE A WORKABLE AGRICULTURAL WEATHER SYSTEM, SERVING THE NEEDS OF CALIFORNIA AGRICULTURE. HOWEVER, THERE ARE SOME AREAS WHERE WE NEED THE ASSISTANCE OF CONGRESS AND THE FEDERAL GOVERNMENT. THE MAJOR PROBLEMS, AT THE FEDERAL LEVEL, WHICH CONCERN US ARE IN (a) UNCERTAINTIES IN THE CONTINUATION OF THE FUNDING FOR NATIONWIDE AGRICULTURAL WEATHER SERVICES; (b) FUNDING OF THESE SERVICES AT A LEVEL WHICH MAKES THEM TRULY EFFECTIVE; (c) MODERNIZATION OF AGRICULTURAL WEATHER SERVICES; AND (d) COOPERATION OF VARIOUS FEDERAL, STATE AND PRIVATE ORGANIZATIONS. THE SOLUTION OF THESE PROBLEMS IS ABSOLUTELY ESSENTIAL FOR THE DEVELOPMENT OF THE TYPE OF WEATHER SERVICES WHICH WOULD INCREASE THEIR USEFULNESS TO GROWERS AND RANCHERS.

WE, THE CALIFORNIA AGRICULTURAL WEATHER TASK FORCE, APPLAUDE THE EFFORTS OF THE AGRICULTURAL RESEARCH INSTITUTE (ARI) IN REVIEWING

AGRICULTURAL WEATHER AND SUPPORT ARI'S SUGGESTIONS IN GENERAL FOR IMPORVEMENTS IN THE FEDERAL AGICULTURAL WEATHER PROGRAM. OUR EFFORTS IN CALIFORNIA ARE CONSISTENT WITH ARI AND SHOULD CONTRIBUTE TO ARI'S EFFORTS TO IMPROVE THE FEDERAL PROGRAM. IN FACT, OUR TASK FORCE HAS BEEN CITED AS AN EXAMPLE OF THE STATE "P/C BOARD" DISCUSSED IN THE ARI BLUEPRINT.

THE USES FOR AGRICULTURAL WEATHER FORECASTS AND DATA ARE NUMEROUS AS STATED EARLIER. THERE IS NO QUESTION THAT FARMERS AND RANCHERS BENEFIT FROM THIS INFORMATION. HOWEVER, THE ULTIMATE BENEFACTORS ARE CONSUMERS OF AGRICULTURAL PRODUCTS IN THIS COUNTRY AND, INDEED, THE ENHANCEMENT OF NATIONAL SECURITY.

MANY DIFFERENT FIGURES HAVE BEEN USED ON THE COST/BENEFIT RATIO OF AGIRUCULTURAL WEATHER INFORMATION SUCH AS 70 MILLION DOLLARS FOR CITRUS IN CALIFORNIA ALONE. THE REASON FOR THE VARYING FIGURES IS THAT IT IS IMPOSSIBLE TO ACCURATELY DETERMINE THE ACTUAL BENEFITS OF THIS INFORMATION. I FEEL IT SHOULD SUFFICE TO SAY THAT THE BENEFITS ARE ANNUALLY IN THE BILLIONS OF DOLLARS TO THIS COUNTRY. FURTHER, THE COST/BENEFIT RATIO IS ONE OF THE BEST IN PRODUCTIVITY OF TAX DOLLARS.

ONE MIGHT ASK THAT IF THIS COST/BENEFIT RATIO IS TRUE, THEN WHY DOESN'T AGRICULTURE DIRECTLY PICK UP THE COSTS? WE DO NOT FEEL DIRECT SUPPORT OF AGRICULTURAL WEATHER PROGRAMS CAN BE EQUITABLY ACCOMPLISHED, EVEN IF IT COULD, THE COST OF BILLING, COLLECTING, ADMINISTERING, ETC. WOULD PROBABLY EXCEED THE COST OF THE AGRICULTURAL WEATHER PROGRAMS, IN OTHER WORDS, NOT NEARLY THE COST EFFECTIVE SYSTEM THAT ALREADY EXISTS. IT IS UNREALISTIC TO US TO DEVELOP A PRIVATE SYSTEM OR AGRICULTURAL WEATHER SERVICE TOTALLY SUPPORTED BY USERS.

IT HAS TO BE UNDERSTOOD THAT THE BACKBONE TO ANY AGRICULTURAL WEATHER PROGRAM EITHER NATIONALLY OR LOCALLY IS THE NATIONAL WEATHER SERVICE (NWS). LOCAL, REGIONAL AND NATIONAL AGRICULTURAL WEATHER PROGRAMS AND CURRENT AND POTENTIAL PROGRAM IMPROVEMENTS FOR TOMORROW ARE AND WILL BE BUILT AROUND NWS. THEREFORE, WE FEEL A FEDERAL MANDATE FOR FUNDING OF AGRICULTURAL WEATHER PROGRAMS IN NECESSARY FOR THE STABILITY OF THE SYSTEM. PRIVATE WEATHER ORGANIZATIONS CERTAINLY HAVE A PLACE IN

THE SYSTEM BUT CAN NEVER REPLACE NWS AND, IN FACT, WILL BE VERY DEPENDENT ON INFORMATION FROM NWS FOR THEIR EXISTENCE. MANY SOPHISTICATED USERS OF WEATHER INFORMATION FOR THE MANY MICROCLIMATES, IRRIGATION, BURNING, ETC., CANNOT BE UNIFORMLY DEVELOPED AND ESTABLISHED TO SERVE AGRICULTURE BY PRIVATE INDUSTRY WITHOUT A REASONABLE BASE OR BEDROCK OF INFORMATION AND SERVICE FROM THE NATIONAL WEATHER SERVICE.

I RECENTLY ATTENDED A NATIONAL PROGRAM ON AGRICULTURAL WEATHER PROGRAMS. MANY STATES WERE REPRESENTED AS WELL AS MOST OF THE LEADING RESEARCHERS RELATING TO AGRICULTURAL WEATHER USE. IT BECAME APPARENT TO ME THAT FEDERAL COORDINATION OF ALL THE DIFFERENT PROGRAMS IS BADLY NEEDED. ALSO, A LOT OF EFFORT NEEDS TO GO INTO AN ACTIVE EDUCATIONAL PROGRAM TO KEEP FARMERS AND RANCHERS UP TO DATE WITH THE LATEST TECHNOLOGY ON AGRICULTURAL WEATHER DATA AND HOW BEST TO USE IT.

WE ARE VERY FORTUNATE TO HAVE A LONG-TERM TRADITION IN THE DELIVERY OF QUALITY WEATHER SERVICES FOR THE NATION'S FARMERS. PRESENTLY, WE ARE FACING A CHALLENGE TO BUILD ON THIS STRONG FOUNDATION, AND TO DEVELOP AN EFFECTIVE SYSTEM BASED UPON MODERN METHODS OF DATA MONITORING AND COMMUNICATIONS, AND HARMONIZE THIS ADVANCED SYSTEM WITH THE NEEDS OF MODERN AGRICULTURE. THE NATIONAL WEATHER SERVICE EMPLOYS HIGHLY-TRAINED AGRICULTURAL METEOROLOGISTS, WHO CLOSELY MONITOR WEATHER PATTERNS WHICH COULD BE POTENTIALLY DEVASTATING TO OUR FARM CROPS. THEIR FORECASTS ARE MADE AVAILABLE TO FARMERS AND RANCHERS THROUGH TELEVISION, RADIO AND TELEPHONE ON A BROAD BASIS. RECENT SCIENTIFIC DEVELOPMENTS IN TELECOMMUNICATIONS, WEATHER SATELLITE TECHNOLOGIES, AND FARM COMPUTER USE ARE FACTS OF NATIONWIDE IMPORTANCE.

WE HAVE OVER 250 CROPS PRODUCED IN CALIFORNIA AND 80,000 FARMERS, OF WHICH 40,000 ARE FULL-TIME AND APPROXIMATELY 40,000 ARE PART-TIME. IT IS NOT REASONABLE TO ASSUME THAT THE PRIVATE SECTOR CAN PROVIDE ADEQUATE BASE LINE WEATHER SERVICES TO THE WIDE ARRAY OF FARMERS IN CALIFORNIA. MANY OF THE LARGER FULL-TIME FARMERS COULD SUBSCRIBE TO PRIVATE PROVIDERS BUT THERE NEEDS TO BE A STABLE BASE LINE SERVICE FROM THE FEDERAL WEATHER SYSTEM TO ASSURE ADEQUATE INFORMATION SO ALL FARMERS CAN HAVE BASIC INFORMATION NEEDED TO PLANT, IRRIGATION, FERTILIZE, SPRAY, HARVEST AND BURN RESIDUE.

YOU HAVE BEFORE YOU A RATHER UNIQUE OPPORTUNITY. IN TODAY'S SOCIETY WE OFTEN GO FROM ONE CRISIS TO THE NEXT IN DEALING WITH PROBLEMS. WE ARE NOT, HOWEVER, CURRENTLY IN A MAKE-OR-BREAK SITUATION WITH AGRICULTURAL WEATHER, SO YOU CAN MAKE LOGICAL AND WELL FOUNDED PLANS TO ENSURE THAT A CRISIS WILL NOT BE FACED TOMORROW AND WE CAN EFFECTIVELY PLAN OUR PROGRAM. YOU HAVE SEEN FIT FOR THE PAST THREE YEARS TO REINSTATE THE AGRICULTURAL WEATHER BUDGET AND WE THANK YOU FOR YOUR SUPPORT. THIS IS NOT TO SAY THAT A LOT MORE DOES NOT NEED TO BE DONE BECAUSE IT DOES. WE STRONGLY RECOMMEND 1) STABILITY FOR AGRICULTURAL WEATHER PROGRAMS; 2) WE NEED TO BRING CURRENT PROGRAMS UP TO DATE WITH TECHNOLOGY THAT ALREADY EXISTS AND BE BETTER PREPARED TO MORE READILY INCORPORATE NEW TECHNOLOGY INTO THE PROGRAMS; AND 3) WE NEED COORDINATED EFFORTS BETWEEN LOCAL, STATE, REGIONAL AND NATIONAL PROGRAMS. THIS WILL ALLOW A BEDROCK OF WEATHER INFORMATION FOR ALL AGRICULTURE AND FOSTER PRIVATE DEVELOPMENT AND TECHNOLOGY TO SERVE THE MORE SOPHISTICATED FARMERS, AND MICROCLIMATES THAT EXIST.

EFFECTIVE AGRICULTURAL WEATHER SERVICES ARE ESSENTIAL NOT ONLY TO FARMERS AND RANCHERS, BUT TO THE WHOLE SOCIETY---TO PEOPLE IN THIS COUNTRY AND ABROAD. WE HAVE A CHALLENGE OF FEEDING THE CONTINUOUSLY INCREASING WORLD POPULATION. FROM THE ECONOMIC POINT OF VIEW, THE EXPORT OF FARM COMMODITIES IS ESSENTIAL TO OUR NATIONAL ECONOMY. WE HAVE TO REDUCE THE RISKS IN THE PRODUCTION OF FOOD COMMODITIES. THE POLICIES TOWARD THE DEVELOPMENT OF EFFICIENT AGRICULTURAL WEATHER SERVICES, AT THE FEDERAL, STATE, AND COUNTY LEVELS, AND ON FARMS, ARE ESSENTIAL STEPS FOR SECURING FUTURE FOOD SUPPLIES.

I AM CONFIDENT THAT THE ISSUE OF AGRICULTURAL WEATHER CAN BE EFFECTIVELY DEALT WITH IF WE; FEDERAL, STATE AND LOCAL REPRESENTATIVES; ALL WORK TOGETHER. SPEAKING FOR THE CALIFORNIA AGRICULTURAL WEATHER TASK FORCE AND THE CALIFORNIA STATE BOARD OF FOOD & AGRICULTURE, I CAN SAY WE WILL COOPERATE IN EVERY WAY WE CAN TO SUPPORT THIS COOPERATIVE ENDEAVOR IN THE INTEREST OF OUR AGRICULTURAL INDUSTRY AND THE CONSUMER.

Mr. **Brown**. Thank you, Dr. Smallwood.

Ms. Damiano, if you—both of you—can wait about 10 minutes so that we can go make that vote, we will return. I apologize again for the delay.

[Brief recess.]

Mr. **Brown**. The subcommittee will come to order.

Again, we apologize, Ms. Damiano. You may proceed with your statement.

STATEMENT OF GAIL UFFORD DAMIANO, PROGRAM DIRECTOR, COMMODITY SERVICES DIVISION, CALIFORNIA FARM BUREAU FEDERATION

Ms. **Damiano**. Thank you, Mr. Chairman.

My name is Gail Ufford Damiano, and I am a program director for the California Farm Bureau Federation, Commodity Services Division. I am here on behalf of the California Farm Bureau, which represents over 100,000 member families and an estimated 85 percent of the farmers and ranchers in the State. The farm bureau has supported maintenance of funding for agricultural weather services for a number of years. Having followed the situation closely and seeing little resolution of the problem we are here to address today, I, too, would like to congratulate the subcommittees and Congressman Brown for calling this hearing to receive information that may help us achieve the goal of a coordinated, ongoing system.

I would like to submit my written comments for the record, and instead summarize key points and observations, if I may.

Mr. **Brown**. Without objection, so ordered.

Ms. **Damiano**. The farm bureau is concerned about the reliability, coordination, and efficiency of existing Federal agricultural weather operations. When I speak of agricultural weather operations I am referring to agricultural weather, fire weather, and fruit frost programs provided by the National Weather Services. Although I am not totally familiar with the operations of the fire weather program, we have considered all three in one group due to the cross utilization of meteorologists within the National Weather Services System.

May I ask if you can hear this correctly?

Mr. **Brown**. Yes; you are on.

Ms. **Damiano**. OK, thank you.

In regards to reliability of Federal programs, the growers with whom I come in contact place great faith in the ability of their local National Weather Services forecaster. This forecaster represents the National Weather Services to them, not the system we are addressing today. But at the forecaster level there is some frustration about the need for more personnel and advanced technology to provide the service for which they see a demand.

In response, growers and grower groups have voluntarily contributed financially or in kind to support the physical requirements of the forecaster, but can do little in the personnel area. National Weather Services administrators have expressed difficulty in recruiting and maintaining personnel under the continuing proposals to remove Federal funding. Overall, I feel that the insecure funding base we have experienced has had a negative impact on the program, and that some degree of stability must be developed before user enthusiasm does wane.

And users have been both enthusiastic and contributing to local agricultural weather programs. However, there has been very little coordination or acknowledgement of this contribution. This has resulted in a proliferation of independent State and county networks that have been mentioned in earlier testimony.

Some counties or regions have no service, and others have an overlap between programs from many sources. And basically, these independent networks have sprung up to address needs such as flood warnings, snow pack depths, frost protection, pest management, et cetera. The National Weather Services has not been a driving force in providing the coordinated program, but neither has the USDA or the Extension Service. And really, there has been no incentive for one network to reach out and adjoin another one, especially since the networks are addressing local needs.

Well, with the goal of developing a more secure coordinated agricultural weather program, the Farm Bureau became a member of the Agriculture Research Institute, and has participated with the agricultural meteorology study panel in development of the current proposal.

The concepts behind the proposal from ARI are good, and Farm Bureau policy supports: One, coordination of user and Federal funds; and two, legislation to mandate that agricultural weather services be maintained as a Federal program with joint planning between the National Weather Services and the USDA.

We also endorse the development of an interagency task force to help forge coordination at upper administrative levels, as this has met with some degree of success at the State level, such as Dr. Smallwood mentioned.

The ARI proposal addresses the lack of clear role definition which has been a contributor to the problem we have experienced in coordination and cooperation in California. Without clearly defined roles, entities that provide some type of weather information service seem to defend programs that they really can't adequately fund or staff in an effort to maintain some segment of the action or piece of the pie. And the pie is clearly big enough if we all know who is responsible for what.

The question has come up, time and time again, can the private sector complement and support a national weather system for agriculture? The message I have gotten from this hearing is yes; as long as the National Weather Services stays in. Private industry does not appear to be pounding at the door to take over this program. It should be apparent by now that some continuity and coordination must exist. And this is a role best performed by the Federal Government.

Since our members are users of these programs, we at Farm Bureau focused heavily on what they want, with the goal of fostering a system based on their needs. Our overall goal in Farm Bureau is to enhance the farm economy, and we look at the availability of agricultural weather information as a way to lower the cost of inputs and reduce reliance on farm program supports.

Access to the right information at the right time is the key to managing inputs, and that is where agricultural weather comes in.

It is important that we look at what actually is being used by California growers, and how. The California Department of Food and Agriculture Task Force, of which Farm Bureau is a member and Dr. Smallwood summarized the results of our survey, has labored long and hard to document this.

It should be noted that the No. 1 and No. 2 uses, which were what over three-fourths of the respondents said they used, are in the harvesting and chemical application area. That is, uses of agricultural weather information. And these are very regulated and often controversial areas. Fruit frost protection was No. 3, which is a very expensive area for both growers and consumers. And I agree heartily with the chairman, that we need to get this Nation more productive. Government's attempted answer has been traditionally farm price supports, crop insurance, and other complicated procedures. In helping provide a good agricultural weather service, the Government has the opportunity to help growers increase their productivity on more of a "self-help" basis. This seems to be an ideal and natural role.

A user whose needs are sometimes overlooked is the consumer. And that is who farmers are producing their product for. Not only does an efficient agricultural weather information system save them money, which has been discussed earlier, but some of the pressures we face with an increasingly urban population can be relieved with judicious use of weather information. A program to forecast what we call burn days for rice producers has been developed by Nowcasting, who you heard from through Dr. Hauser, yesterday. This is in the Sacramento Valley area, and has helped reduce complaints about smoke considerably, which is especially important since that is our State Capital, and all our lawmakers are there.

Another area of friction between the rural and urban community is our use of limited water resources. It has been estimated that 85 percent of California water use is agricultural. And any perceived waste causes a lot of problems. Through cooperative programs such as CIMIS, which is an acronym an acronym for what includes as participants the University of California, the Department of Water Resources and the National Weather Services, we are hopeful that irrigation efficiency can be fine-tuned.

Again, we are encouraged that these hearings are being called to look at the roles of the various entities involved in agricultural weather programs, and why they are not working as a cohesive functioning unit. One way to address this would be to enact legislation to mandate that agricultural weather services be a Federal program with joint planning between the National Weather Services and the USDA. That would be a first step toward a coordinated, cooperative effort.

I would like to point out that we are not opposed to user contributions to the functioning of these programs. And, as I mentioned earlier, significant amounts of industry money have already been used. In fact, we are supporting a bill in the California Legislature that would authorize State marketing orders to provide funding.

Although we agree that an organized mechanism to pool resources is needed, we are not supportive of user fees, due to the complexity of trying to administer such a program. And I know there has been reference to this in other statements.

Agriculture weather programs are needed. As currently operated, without authorization or a Federal agency who seems to want to administer them, they are a high profile item for annual budget cutting. These programs need a secure base at the Federal level so that we at the State level can get on with the business of developing systems tailored to the needs of agriculture and consumers in our area.

I appreciate the opportunity to express our views, and I would be happy to answer any questions.

Thank you.

[The prepared statement and biographical sketch of Ms. Damiano follows:]

California Farm Bureau Federation
1601 Exposition Boulevard • Sacramento, CA 95815 • Telephone (916) 924-4000

STATEMENT OF CALIFORNIA FARM BUREAU FEDERATION
GAIL UFFORD DAMIANO, PROGRAM DIRECTOR
COMMODITY SERVICES DIVISION
REGARDING
NATIONAL COORDINATION OF WEATHER PROGRAMS
FOR AGRICULTURE TO THE SUBCOMMITTEE ON
DEPARTMENT OPERATIONS, RESEARCH, & FOREIGN AGRICULTURE
AND THE SUBCOMMITTEE ON NATURAL RESOURCES
U.S. HOUSE OF REPRESENTATIVES
JUNE 27 - 28, 1984

My name is Gail Ufford Damiano, and I am a Program Director for the California Farm Bureau Federation Commodity Services Division. I am here on behalf of the California Farm Bureau which represents over one hundred thousand member families and approximately 85% of the farmers and ranchers in the state. Farm Bureau has supported maintenance of funding for agricultural weather services for a number of years. Having followed the situation closely and seeing little resolution of the problem we are here to address today, I congratulate the subcommittees and Congressman Brown for calling this hearing to receive information that may help us achieve the goal of a coordinated, ongoing system.

I plan to address the objectives as stated in the hearing charter, and as a representative of a user-organization, bring forth some of the needs we have seen. Since I have the honor of being last on the agenda, I would also like to comment on some of the prior presentations.

Farm Bureau is concerned about the reliability, coordination and efficiency of existing federal agricultural weather operations. When I speak of agricultural weather operations, I am referring to agricultural weather, fire weather, and fruit frost programs provided by the National Weather Service. Although I am not totally familiar with the operations of the fire weather program, all three of should be considered in one group due to the cross-utilization of meteorologists within the National Weather Service system.

On the other hand, some things are working. Utilization of forecasters in fire weather districts half the year and fruit frost districts the other half can be very economical. Also, the ability of the National Weather Service to provide a meteorologist on a part time basis for agriculture, in addition to general functions, can work out very well. As pointed out by other speakers, there is some sharing of information between National Weather Service and other entities but not always openly or two-way. Things seem to be changing however, much of it due to the adversity that has faced this program.

Farm Bureau is a member of the Agricultural Research Institute and has participated with the Agricultural Meteorology Study Panel in development of the current proposal. The concepts behind the "blueprint" are good. Farm Bureau policy supports 1) coordination of user and federal funds and 2) legislation to mandate that agricultural weather services be maintained as a federal program with joint planning between the National Weather Service and the USDA. We also endorse the development of an inter-agency task force to help forge coordination at upper administrative levels as this has met with some success at the state level. The ARI proposal addresses the lack of clear role definition, which has been a contributor to the problems we have experienced in coordination and cooperation in California. Without clearly defined roles, entities providing some type of weather information service will defend programs that are not

Since our members are users of these programs, we have focused on what they want with the goal of fostering a system based on their needs. Our overall goal in Farm Bureau is to enhance the farm economy and we look at the availability of agricultural weather information as a way to lower the cost of inputs and reduce reliance on farm program supports. The uses of agricultural weather information by our members ranges from crop models, water budgets, integrated pest management and site-specific information to wanting a basic service that covers their hard-to-reach growing area. Access to the right information at the right time is the key to managing inputs. Although weather cannot be altered at the present time, there are many realistic strategies that we feel can be used to reduce the adverse effects on agricultural production.

In an effort to see what actually is important to farmers in California, we ran a preliminary survey of 400 plus growers for the California Department of Food and Agriculture Task Force, of which we are also a member. When asked how growers used weather information in their operations, the respondents listed the following in order of priority: harvesting, chemical applications, frost protection, irrigation timing, planting, pest management, burning, and labor scheduling. These are known to be high cost-input activities, however, there has been little specific bottom-line documentation as to how much money can be saved. This type of information is crucial as a coordinated system

Again, we are encouraged that these hearings have been called to look at the roles of the various entities involved in agricultural weather programs and why they are not working as a cohesive functioning unit. One way to address this would be to enact legislation to mandate that agricultural weather services be a federal program with joint planning between the National Weather Service and USDA. That would be the first step toward a cooperative, coordinated effort.

We are not opposed to user contributions to the functioning of the programs. Significant amounts of industry money already have been used. In fact, we are supporting a bill in the California legislature that would authorize state marketing orders to provide funding. Although we agree that an organized mechanism to pool resources is needed, we are not supportive of user fees due to the complexity of trying to administer such a program.

Agricultural weather programs are needed. As currently operated, without authorization, or a federal agency who wants to administer them, they are a high profile item for the annual budget cut process. These programs need a secure base at the federal level so that we at the state level can get on with the business of developing systems tailored to the needs of agriculture and consumers in our area. I appreciate the opportunity to express our views and will be happy to answer any questions. Thank you.

BIOGRAPHICAL SKETCH

GAIL UFFORD DAMIANO is the Commodity Services Program Director for Grapes, Subtropicals, and Ornamentals with the California Farm Bureau Federation (CFBF). In that capacity she works directly with the membership providing policy analysis on areas of concern to her specified commodities and implements the resulting Farm Bureau programs. Ms. Damiano is also coordinator of the CFBF Agricultural Weather Committee and is a member of both the California Agricultural Weather Task Force and the Agricultural Research Institute Meteorology Study Panel. She has worked with Farm Bureau for the past five years. Prior to that she was a loan officer with Production Credit Association and a public service intern with the University of California Cooperative Extension. A 1978 graduate of the University of California, Davis, with a B.S. in Agronomy, Ms. Damiano was born in Los Angeles, California and is part owner of a family farm in South Dakota.

Mr. **Brown**. Thank you, Ms. Damiano.

Actually, in addition to a checkoff on producers, you can probably finance this whole program with a very, very small contribution from urban water users based upon the economies in water use that would be provided.

Do you have any questions, Mr. Roberts?

Mr. **Roberts**. Yes, Mr. Chairman, thank you.

I would like to thank you both for two fine statements, especially from the producers' standpoint, Dr. Smallwood, your rundown here of the survey is extremely interesting as far as I am concerned. Am I to understand that basically the survey you are referring to is the same one that was taken by the California Farm Bureau?

Dr. **Smallwood**. Ms. Damiano was chairman of this subcommittee that conducted the survey, and Farm Bureau was a participant in that, as well as other grower groups and users.

Mr. **Roberts**. So you had all the grower groups and users helping to finance this survey?

Dr. **Smallwood**. Well, we financed it through the Department of Food and Agriculture, but they were the participants, the respondents.

Mr. **Roberts**. I saw a negative shake of the head to your right and my left. Do you care to comment in that regard?

Ms. **Damiano**. This has been a cooperative program between the Department of Food and Agriculture and the California Farm Bureau and a couple of other organizations. We have assumed all the printing costs; the department assumed the mailing costs; the University of California has been contributing to the computer time costs. So that is the funding source.

Mr. **Roberts**. What has the National Weather Services contributed?

Ms. **Damiano**. They contributed in the development of a survey questionnaire and some of the technical questions that we needed to ask. They are also members of the task force in contributing technical information. But in the financial area it has been, as I said, provided by the different entities.

We should have approximately a thousand or so surveys compiled when it is completed.

Mr. **Roberts**. That was my next question. You mentioned 400 users. Is this pretty much across the State, or is it in one particular area?

Dr. **Smallwood**. It covers the State pretty well. I think every county—all but one county. We have respondents from all but one county in the State.

We have completed about half of the tabulations on this. This represents about half of the potential 1,200 that we feel like we will have on completion of the survey.

Mr. **Roberts**. I will go back to my earlier question. Are you enjoying the support of all grower groups, all producer groups, all farm organizations in this?

Dr. **Smallwood**. No; I would not say all. We do not have a budget as a task force, so many of the participants such as the Farm Bureau, the Department of Water Resources, the State Department of Food and Agriculture, the University of California Extension Service were all carrying a share of this. The University of

California conducted the technology survey, where are the weather stations and the agencies and so forth. They pretty well carried that through their own funding and mail-out and cost of the survey.

So we are receiving support from the University of California, the Department of Food and Agriculture, the Farm Bureau, and many of the other participants on the committee.

Mr. ROBERTS. Have you asked the other farm organizations that perhaps should be involved to come to the party?

Dr. SMALLWOOD. Oh, I think the Farm Bureau is the major farm organization. We have commodity groups included also in this. A representative of the collective organization CCRAC, which is a commodity group of all of the various commodities, and that—they have a representative on the committee also.

I would say the Farm Bureau is the major farm producer organization. There are others.

Ms. DAMIANO. Mr. Chairman, may I address that question also?

Mr. BROWN. Yes; certainly.

Ms. DAMIANO. We have worked closely with Sunkist Growers in the Riverside area when the program was initially fruit frost area alone, which is their major interest. We have also worked closely with a local grape group in the Stanislaus County area, the Grape Improvement Association, and have endeavored to have a mailing list of all other associations that would be interested, and keep them informed. However, we have not had participation at our meetings from those. We held two task force meetings in 1980 under the auspices of the California Farm Bureau, and had numerous associations attending or sending representatives.

Dr. SMALLWOOD. We are also surveying all of the private agencies that are participating. Nowcasting, for instance, all of their cooperators also have been mailed surveys and are cooperating in this.

Mr. ROBERTS. Dr. Smallwood, you indicate on page 5 of your testimony that you have come up with a cost/benefit ratio of weather information as approximately $70 million. You were a little vague on how you reached this figure. But if anything like that is even remotely true, why, certainly that should be a real factor in your argument.

How did you arrive at that?

Dr. SMALLWOOD. This figure came from the commodity representative on our committee.

Mr. ROBERTS. Is the National Farm Bureau aware of what you are doing out there, Gail? Have you let John Doud and the boys here in Washington know what you are up to out there?

Ms. DAMIANO. Yes; I have. They have helped significantly in this area. In fact, it is the American Farm Bureau policy that we are promoting here in terms of the Federal mandate and the joint funding. It is an American Farm Bureau policy. We do have a representative from the American Farm Bureau here at this hearing, in the audience.

Mr. ROBERTS. Are you aware of any other State Farm Bureau organizations who are providing a similar function?

Ms. DAMIANO. The Florida Farm Bureau is also very interested in this, as is the Michigan Farm Bureau. And we have worked with both of those Farm Bureaus in this area.

Mr. ROBERTS. Seeing we have the apple and orange Farm Bureau contingent, we just have to get the grain boys off their haunches and get them to do something.

On page 7, you said you are not opposed to user contributions, but you are opposed to user fees. And you make that distinction. And you go on to say that the State of California, at least, has some legislation.

What are you referring to there? Sort of a checkoff kind of system with a marketing order to help fund this program, or what?

Ms. DAMIANO. There have been various ways proposed to fund agricultural weather services. There are currently grower moneys going toward the services voluntarily. Therefore, we are not opposed to this action, nor are we opposed to growers, say, on a matching funds basis of some sort, whatever they chose to, voluntarily. They are happy to contribute to a program which they feel is beneficial and has some future to it.

The marketing order proposal would authorize a marketing order to do so, and is specifically related at this time to authorization only, not requiring that a marketing order do a checkoff. The driving force behind that is the rice industry, which would like to fund an ongoing program for burning. And they would undoubtedly do so via a line item in their marketing order versus, say, a specific checkoff from their growers, since the Rice Research Board feels that the burning problem with rice is so important that they perhaps should fund an ongoing program to do so.

Mr. ROBERTS. I appreciate your testimony. You have put a bug in my ear to contact the corn growers and the wheat growers. I am not quite sure what we can come up with, but it is at least worth exploring. And I do appreciate your very candid statement about user fees, which I think open up a Pandora's box of all sorts of regulation, paperwork, and Lord knows what else.

Thank you both, for two very fine statements.

Mr. BROWN. Let me just pursue this a little bit further, with regard to the marketing orders. Are the marketing orders broad enough in California to permit a checkoff for an operational program in weather of the sort that we are moving toward here?

Ms. DAMIANO. The marketing orders in California primarily cover the fruit and vegetable commodities. Each marketing order would have to decide on its own whether it felt it was in its industry's best interest to amend its order and then send it out to referendum vote. So it would definitely be somewhat autonomous actions. I would not rely on it as a uniform way that everyone would fund it. It would be voluntary because each grower would vote on it through referendum. It would be a major amendment.

Also, our user needs survey that we have been working on with the Department of Food and Agriculture, we have made a very specific attempt to survey a number of the other commodities that are being mentioned by Congressman Roberts in the area of wheat, corn, beef, some of the—what we consider—Grain Belt type commodities, and we are getting a very good response. So perhaps it is an educational effort. Once we send them the information, they respond by saying "Yes, I do use weather parameters in these areas." And those are not covered by marketing orders in general.

Mr. BROWN. Dr. Smallwood, I am interested in the basis for your involvement in this out of Fresno State University. You are not a land grant institution there at Fresno, although you do a lot of agricultural research and training. Was there any problem in your playing the role that you played in connection with this?

Dr. SMALLWOOD. No, there hasn't, Mr. Chairman. I represent the State university system on the State Board of Food and Agriculture. The University of California and the State system has representatives on the State Board of Food and Agriculture, and I am the representative for the CSU system, and was assigned this responsibility by the chairman of—or the president of the State board.

And I must say that we in many of our agricultural activities have tremendous cooperation and interface between the university, the State Department of Food and Agriculture, and our CSU system. So we have enjoyed excellent cooperation. I think you can see one of our task force members here is very articulate and represents an organization that really makes a contribution. And the others have also been as efficient in their contributions to the committee.

Mr. BROWN. Well, despite her articulateness, I notice she stumbled over one or two words. [General laughter.]

Dr. SMALLWOOD. Yes.

Mr. BROWN. But she will improve the next time.

Dr. SMALLWOOD. I could tell you where she went to school, but I won't.

Mr. BROWN. I know where she went to school.

All right, we do appreciate your testimony this morning and now into the afternoon. It has been very helpful to us, and I apologize for the disruptions that delayed it. I hope it didn't interfere too much with your schedule.

Dr. SMALLWOOD. Mr. Chairman, I would be pleased to send the committee a copy of our final report when we finish.

Mr. BROWN. Well, I intended to ask you to do that and we would very much appreciate it if you would.

Without objection, I would also like to have inserted in the record testimony in communications from an additional group of persons who were not able to testify in person, including Dr. Rosenberg from the University of Nebraska at Lincoln; Dr. Mueller from Louisiana State University; and also to include a reprint on "Weather Services in the Nation's Economy;" and a letter from Ohio State University; and testimony of Dr. Stanley A. Shangon, chief of the Illinois State Water Survey; and other miscellaneous testimony, including Purdue. I want to mention the name of all these important institutions.

Without objection, that will be made a part of the record.

[See appendix, p. 349.]

And without, I think, any further testimony, the subcommittee will be adjourned.

Thank you very much.

[Whereupon, at 12:53 p.m., the hearing was adjourned.]

APPENDIX

STATEMENT OF THE HONORABLE PAT ROBERTS

June 27, 1984

Mr. Chairman, today and tomorrow we will be hearing from a number of witnesses as we undertake the examination of the need for a national agriculture weather system. These witnesses should provide useful information that we can use in fashioning some answers to the various problems confronting the present agricultural weather program. All of us are aware of the past efforts to eliminate the agricultural weather service program, the fire weather program and the fruit frost forecast program as well as the recent proposal to sell the weather satellite system to private interests. There also have been past discussions about putting some of the agricultural weather services on a user fee basis.

We all recognize the benefits that accrue to producers nationwide from the present agricultural weather program as they use these services in deciding when to plant, irrigate, spray pesticides, harvest and a host of other services. Two GAO studies, one in 1978 and one in 1979, suggested that Congress should take a serious look at the agricultural weather service programs and determine what was needed and the requirements to serve those needs. Of course the ultimate question in this day of increasing deficits is how to fund such programs.

These hearings will provide the opportunity for us to explore the various problems and to determine whether there is a need for a nationwide program similar to the aviation weather program or whether a less comprehensive program would do the job. I am particularly intrigued by the Nebraska agricultural weather information program. However, much of the Nebraska system's success can be attributed to the computer network AGNET operated by the University of Nebraska, which has been a pioneer in bringing the computer to the farmer. One thing the Nebraska system points out is the valuable contribution that the Extension Service and the land grant community can provide in making an agricultural weather system work. Along with the recognition of a need for a system I hope that the witnesses can address the question of how to pay for such services. Should it be all government, all private or some combination thereof? I recognize that some areas of the country use agricultural weather forecasts more than others and I would hope that this issue can be addressed in these deliberations. And finally, when we think of a national agricultural weather program, the problems of information dissemination systems, who will control and process the data, and possible conflicts between the public and private sectors come to mind. These two days of hearings will not, I am certain, give us all the answers but it is a start in the right direction.

Thank you, Mr. Chairman, for permitting me to make this statement.

TESTIMONY FOR JUNE 1984 HEARINGS ON NATIONAL AGRICULTURE WEATHER SERVICE OPERATIONS

Stanley A. Changnon, Jr. Chief
Illinois State Water Survey
Champaign, Illinois

The issue of agricultural weather services must be taken in the largest possible content, cognizant of the history of its development, and the needs related to the continuing shifts in agricultural practices and resulting uses of weather and climate information.

Agricultural weather operations embrace use of a range of services including forecasts (current state of atmosphere and that of the next few hours or days), and climate products such as the summary of current conditions, in a year-to-date sense, and compared to last years value and the normal value. I wish to particularly address the climate products and services, and not the weather aspects of the agricultural weather issue.

For the past 20 years, the Illinois State Water Survey has performed research on climate and agriculture, particularly to understand the effect of climate on midwestern crop production. We currently are performing three major projects and one, funded by NSF, is to discern the need for long-range climate predictions by midwestern farmers and agribusinesses. A second concerns the use of long-range climate predictions for the crop-hail insurance industry, and third addresses the impacts of weather modification on midwestern crop production. The point is that we have expertise and understanding as it relates to weather and climate influences on corn and soybean agriculture, plus a working relationship with state and federal agencies, and agribusinesses in performing this research.

However, I want to address climate services, not research, to agriculture. We were supportive of the National Climate Program Act in 1978 strongly believing in the value of delivery of climate data and information, through the Intergovernmental Climate Program (ICP). The failure of the federal government to launch a significant ICP, led a north central regional agricultural committee to plan and propose a project to demonstrate how to launch a meaningful state-federal partnership in climate services to agriculture. This effort, which is funded by the National Climate Program Office and the State of Illinois, involves our operation of a regional climate center for the 12 north central states. We help both federal agencies and state climate centers, assisting in data management, climate information transfer, and in organizing meaningful regional reseach.

Another part of Illinois' climate services effort involves two other projects critical to my testimony. For the past two years, with agribusiness and NSF funding, we made an extensive assessment of agribusiness uses and needs for climate data and information. Two of the major conclusions were that there is a great demand for year-to-date, real-time climate data and information (how much rain this season, how did it compare to last year, how does it compare to normal), and there is inability to get certain kinds of climate data desired to make decisions.

The second project closely related to the first two was establishment of a Climate Assistance Service (CLASS) in Illinois. With grants from the National Climate Program Office, and the State of Illnoois, we established a user friendly computer-based climate system. We are in a demonstration mode, providing climate data-information to federal agencies in and around Illinois, state agencies in Illinois, and certain agribusinesses. We constantly update the information with daily weather data being supplied to us via telephone by over 50 weather observers in Illinois, and we in turn generate 240 different climate products, pages of information, users can access ranging from soil moisture to insect pest information.

This background of activities directly related to the "agricultural climate services" leads to our views about the issues being addressed in these hearings. We have three observations.

1. Realtime climate data/information is of key importance to agriculture, particularly if provided on both state and regional scale.
2. The development and installation of regional and state systems are most easily accomplished at the federal/state level.
3. The utility of such information will lead to financial support from agribusiness, sufficient to operate and maintain such systems after installation.

Such state and regional climate data systems serve not only the important information and needs of many agribusinesses but also those of farmers at all economic levels. The wealthier farmer can utilize information in sophisticated management systems, as can farm managers, and the less fortunate farmers still have easy access to inexpensive data to utilize in decision making.

The federal climate data system basically lacks the ability to provide data on both the time and space scale desired by many agribusinesses. This is not to diminish the value of the near real-time climate products of the Climate Analysis Center, but only to say that the available products and the spatial density of the data are often not adequate for many agribusiness needs. The recent development of the weather data collection system in the Central Region by the National Weather Service has been an important move towards developing a real-time climate delivery system for the midwest. The development of a CLASS-type system but on a regional basis could become the nation's first major regional system for providing real-time climate data and information. There are other state-level systems developing in Florida and Nebraska, revealing the interest in this part of the system

Following are answers to three primary questions, as they relate to climate data and information.

A. Why doesn't an agricultural-climate system exist now? It has just been fully realized that climate information is relatively cheap, relative to the other inputs needed for agricultural production. Furthermore, electronic data collection and computer analysis have collectively have become relatively inexpensive. Technology now allows for development of such a system which would have been impossible 15 years ago and prohibitively expensive 5 years ago.

B. Is there interest in a national system? Yes, our assessment of agribusiness uses and needs for climate data and information reveals an amazing extent of usage. However, such usage requires the collection of data, quality control, archival, and distribution to users. The collection of data, quality control, archival, and data processing to a point of providing easy and real-time access is seen as a government role.

C. What is the role of the federal government? We conclude that the role of the federal government is to collect weather data at a space and time scale adequate to meet the now well recognized needs of agribusiness; to quality control these data; to archive it; to make it available in various formats; and to establish means for transmission of data, including real-time systems. The role of the private sector is to pay for sustaining such delivery systems. State roles can include the establishment and operation of state-scale data collection and delivery systems, if desired. We envision a partnership with the federal government developing the data system, as has been done in Illinois, and the private sector and the states helping to maintain the system on a cost payment basis.

Stanley A. Changnon, Jr.

Biographical Sketch

Stanley A. Changnon, Jr. is the Chief of the Illinois State Water Survey. Prior to this position he was Head of the Atmospheric Sciences Section for 12 years, and is also a Professor of Geography. He has authored more than 280 scientific and technical papers and reports concerning meteorology, climatology, and water resources.

For a paper he co-authored, he was chosen by the American Geophysical Union as the 1964 recipient of the Robert E. Horton Award. Another paper was recognized by the Building Research Institute in 1966 as a Scientific Contribution to the Science of Building, and a 1976 paper was awarded the best of the year by the American Water Resources Association. The American Meteorological Society gave him the Cleveland Abbe Award in 1981 for outstanding contributions to applied atmospheric research.

He is a member of several scientific societies and is a fellow and (past Secretary of Section W), American Association for the Advancement of Science, Weather Modification Association (past President), American Association of Climatologists (past President), and a fellow of the American Meteorological Society. Mr. Changnon served 4 years as Chief Editor of the Journal of Applied Meteorology.

He serves on several major state committees including the Governors Task Force on Drought, the State Water Plan Task Force, and the Governors Council on Coal Development. He chairs the State's Weather Modification Control Board. He also is a member of the President's National Advisory Board on Weather Modification.

TESTIMONY PREPARED

for

Joint Oversight Hearing on a National
Agriculture Weather Operation

House Agriculture Committee's Subcommittee on Department
Operations, Research, and Foreign Agriculture

and

House Science and Technology Committee's Subcommittee on
Natural Resources, Agriculture Research, and Environment

June 27 & 28, 1984

by

Dr. Fred V. Nurnberger
Michigan Meteorological Resources Program

Mr. Chairman and committee members:

Thank you for the opportunity to present my views on this very important topic. To begin, I would like to state my qualification and experience in this area. I received my Ph.D. Degree in 1972 from Michigan State University in Agricultural Engineering with a specialization in Micrometeorology. I went to work for the Michigan Department of Agriculture (MDA)/Michigan Weather Service in September 1972 as Assistant State Climatologist. In this capacity, I was under the supervision of the Federal State Climatologist for Michigan, and we were co-housed with the Federal Advisory Agricultural Meteorologist for Michigan. Since 1973 when the Federal State Climatologist program was eliminated by NOAA, I have been the State Climatologist for Michigan and worked cooperatively with many Federal, regional, state and intrastate programs.

The separation of the state-funded climate program and federally-funded Agricultural Weather Service (AWS) program created inefficiencies in data management, plus duplication of some equipment and support reference materials, plus diminished accessibility to some data sets. Cooperative activities were continued in some areas, however.

During the mid-1970's, many agricultural research and cooperative extension programs were developed at Michigan State University (MSU) and other Land Grant Institutions based upon the availability of the National Weather Service's (NWS) AWS data and specialized services. Upon the NWS's reorganization of the AWS programs into a regional concept in the late 1970's and the need for continued direct daily involvement of an agricultural meteorologist by various MSU programs, a staff specialist position was created at MSU. The daily input to the Integrated Pest Management Program, other research and extension activities, the issuance of agricultural advisories, and liaison work with the NWS were all essential to these programs. All of these activities, however, were and continue to be dependent upon the existence of a Federal AWS program.

The need for improved coordination between the MDA/State Climate Program and the MSU/AWS Program resulted in the adoption of a formal cooperative agreement in May of 1981 creating the Michigan Meteorological Resources Program. I am the designated coordinator of this cooperative program and will relate to it in more detail later.

I agree completely with the background statements presented in the charter for these hearings. During the decade of the 1970's and continuing into the 1980's, the dedicated support to Agricultural Weather Service Programs by the NWS has experienced a continual decline. The services provided and number of trained personnel have continued to decrease. Valuable limited resources have been lost to productivity through their redirection toward the continuing efforts to retain these needed services. The existence of many state and local programs depend upon the continued existence of the data and information from the Federal AWS program. Their loss would be a disaster to agriculture and set back agricultural research and extension activities in this area for many years.

In Michigan, for example, "farmers produce nearly 50 commercial food crops each year"[1]. These are very important and form a stable basis of the state's economy. These range from the well known red tart cherries, blueberries, dry beans, navy beans, and pickling cucumbers, all of which Michigan is No. 1 in the nation, to lesser known commodities, such as mink, popcorn, and snap beans. In 38 commodities, Michigan ranks in the top ten in the nation in production and is in the top five in 20 commodities[2]. Although much research has been done and extension advisory programs developed and implemented, only a small fraction of the problems are solved. Researchers involved in studying these weather-related factors must be assured of the timely receipt of a basic set of agriculturally-important weather data and information services both now and in the future for implementation of management programs. If it is determined by research that specific micro-meteorological data are needed to properly predict and manage certain problems, then supplemental monitoring systems must be implemented at the state, local or grower level to meet these specific needs.

A case in point for this latter activity is the apple scab monitor. Researchers at MSU determined the relevant environmental parameters for the prediction of the onset of apple scab and the potential economic loss of thousands of dollars to each grower. Electrical engineering researchers were able to develop a self-contained field monitor, now commercially available, to assist the growers in knowing when cumulative conditions were right to take preventative action by spraying. Thus the monitor would minimize the risk to the environment by possibly spraying too much and too often as well as the economic loss to the grower by spraying too much or not enough. The monitor, however, only gives the grower information as when the time has come when spraying should begin. It does not give the current or future weather conditions which govern whether spraying can or should take place. This is the role of the Agricultural Weather Service and support advisories. The grower must be assured of receiving reliable relevant weather information on a continuing basis. Specific items of a local interest could be most appropriately provided at the state or county level by trained extension field staff.

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[1] "Michigan Food Facts" Michigan Dept. of Agr., 1982.
[2] "Michigan Agricultural Statistics", Michigan Agricultural Reporting Service, MDA-USDA, Aug. 1982.

Many other cases of a similar nature have been and continue to be developed in areas such as pest management, irrigation scheduling, and others. In all cases, both continuous historical weather data and forecast services are important, the former for model development and refinement and the latter for management implementation. With the terrific advances in microelectronics, we can expect even greater developments in these site specific monitors. The need for historical data and timely forecast information will not be diminished but greatly expanded. More growers will become even more dependent upon these specific forecasts and services.

Some of Michigan's most significant commodity areas requiring detailed agricultural forecasts are the fruit and vegetable growers. Since Michigan is ranked in the top 5 for 8 different fruits and 3 different vegetables[3], it is also of importance to the nation's food supply. These growers need specific high and low temperature forecasts to take preventative action to reduce heat and cold stress to crops; for example, sprinkler irrigation on strawberries and tomatoes for heat stress relief, and starting irrigation systems and wind machines for freeze protection. To continue to protect and improve our environment through wise use of pesticides, herbicides, and fungicides, growers need accurate rain, wind, and humidity forecasts and timely advisories for proper application rates. Not only will the grower's costs be reduced but all consumers will benefit through the reduction of chemical usage and environmental improvements.

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[3] Ibid., page 5

The Agricultural Research Institute's blue-print proposal is a well thought out and viable plan to ensure the continued flow of agricultural climate and weather information. It provides for the general broad-based continuing support necessary from the national level, input and support for specific problems at the local level by the state and/or other local groups, the provision for private sector involvement where appropriate, and feed-back to all levels for continuing improvements.

I would like to refer to the Michigan Meteorological Resources Program (MMRP) for a moment on how we are developing our program in a similar way at the state level. To guide the joint climate and agricultural weather activities in Michigan, we have assembled an advisory committee for the MMRP. Members represent university researchers, departmental administrators, extension field-staff, state agencies, private consultants, NWS & USDA program administrators in the state, and private meteorologists. Meetings are held two to three times a year to review programs, assess progress and develop overall program direction and guidance. The supervising agricultural meteorologist and myself as State Climatologist are responsible for our individual program areas, budgets, and funding sources through our individual administrators. Progress is never as rapid as one would like, but improvements are being made. Best of all, it works!

Both of the individual programs are dependent upon activities at the federal level. The MSU/AWS depends upon the NWS/AWS and the MDA/Climatology Program depends upon the NWS/Cooperative Observer Program and the National Environmental Satellite, Data and Information Service/National Climatic Data Center for the major sources of data. We both also operate special networks at the local and state levels to supplement the NWS data and serve the more specific needs in the state. Neither of the programs could survive without the data and services supplied by the national programs. Michigan was only one of four states that had a continuing climate program when the Federal program was eliminated. If the data collection network and distribution system had been eliminated, I am sure the state program would have been, also. Fortunately, that was not the case and the subsequent enactment of the National Climate Act in 1978 has provided a renewed commitment to this area at the national level.

The USDA, through the research and cooperative extension activities with the states and universities must be given and take a much stronger role in this area. Either a stronger enforceable cooperative relationship must be forged between the Depts. of Commerce and Agriculture to provide these services or it should become the responsibility of USDA. Continued authorization and funding for agricultural weather service activities are vitally important to the future of the nation's agriculture.

I urge this committee and Congress as a whole to prevent a disaster from developing in the area of Agricultural Weather Services by taking prompt appropriate action. Please do not allow another set of shock waves to be put into motion in a manner analogous to those of the ill-conceived demise of the climate programs. We are still feeling perturbations of this action 11 years after the fact and even with the ameliorating impact of the National Climate Act.

Our agricultural productivity and the economic impact on our national well-being are too important not to continue and expand upon this type of a Federal program.

Thank you very much for your time and interest in this important area. Please feel free to contact me if I can be of additional service.

Fred V. Nurnberger, Ph.D.
State Climatologist
MDA/Climatology
417 Natural Science Building
Michigan State University Campus
East Lansing, MI 48824

Telephone 517 373 8338

June 15, 1984

Written Testimony for the Record for the Hearings on National Agricultural Weather Operations, House Agricultural Committee's Subcommittee on Department Operations, Research, and Foreign Agriculture.

"Why A Comprehensive System of Weather And Climate Services Does Not Exist In The United States"

Dr. Robert A. Muller
Professor and State Climatologist
Dept. of Geography/Anthropology and
Dept. of Agricultural Engineering, LSU

I wish to address the question as to why a comprehensive system of weather and climate services does not exist in the United States, whether it is for agriculture, or for that matter, for commerce and industry and the general public.

One of the very basic reasons why we do not have an excellent integrated national and state program of weather and climate services revolves around the focus of the academic discipline of meteorology, or atmospheric science. Stated too simply, meteorology is about weather forecasting of the states and conditions of the "atmosphere," and atmospheric science focuses on the scholorly understanding of "atmospheric" processes. Many of the administrators and decision makers of NOAA come out of this "atmospheric" tradition and perspective, and they do not focus at all on microclimate and impacts at the surface.

In addition, the National Weather Service (NWS) is charged primarily with weather forecasting, and probably because the NWS and its parent agency, NOAA, are organized within the Department of Commerce, the forecasting emphasis has been largely towards commerce and transportation. Almost all of the NWS offices are located at airports where they serve directly the needs of aviation; these offices are rarely located in the cities or their residential suburbs, and almost never out in the rural or agricultural countryside.

Most of the requests for weather and climate information in our state climate office, however, are about how the weather affects just about everything else, environmental, human, and economic systems, down "at the earth's surface." With the exceptions of the atmospheric and oceanographic scientists and the aviation people, the requests are not so much about the atmosphere directly, but more about how atmospheric conditions are affecting crops, trees, animals, fish, people, the economy, and a great range of environmental interactions and responses including soil moisture, droughts, floods, and freezes, for example.

Except for the agricultural and marine weather forecasts, most of these topics are not within the normal training and experiences of meteorologists; instead, they are mostly within the realm of climatology. But until quite recently NOAA has generally viewed climatology, again too simply, as the dusty domain of meteorological records of each place organized statistically for various purposes, including as an example, the determination of 30-year normals of temperature and precipitation.

Much of climatology focuses on the interactions of energy and moisture at the "surface of the earth." It is a subject that includes not only some meteorology, but it also spills over into geography, hydrology, the agricultural sciences and forestry, wildlife and fisheries, and most of the social science disciplines that are concerned with how humans respond individually and collectively to weather and climate.

Agroclimatology, for example, depends initially on solar radiation data to drive the basic energy input models of crop development and yield, but NOAA maintains a nationwide solar radiation network of less than 40 stations. This network of less than one station in each state is totally inadequate for agroclimatology, and for that matter, for any other environmental or economic application. But within the NWS there is little interest in the solar radiation network because solar radiation does not enter directly into the global models that are used to predict the state of the atmosphere.

With severly limited budgets, NOAA, has had to curtail many if not most programs that are not directly related to atmospheric forecasting, climate dynamics, and a broad scope of oceanographic matters. The solar network may not survive! As one more example, there is little interest in maintaining the cooperative climatic station network where daily rainfall is recorded at very low costs by volunteers at more than 10,000 stations. Indeed, I have listened to senior NWS people talk about replacing the "tin can network" with satellite technology - a great idea but probably a long time in the future. Again, the NWS does not need to make use of detailed rainfall patterns after the fact in the atmospheric forecasting models, and it is understandable that the NWS has little interest in this network that is so important to environmental interests.

Serious attention also needs to be directed towards reorganization of weather and climate information services and studies in terms of both horizontal and vertical integration of efforts. The horizontal integration should be at the federal level. Effective horizontal integration includes not only elements of NOAA, but also some activities of NASA, especially the ones which focus on monitoring of environmental and economic status in a real-time mode; some of the streamflow and water-resource programs of USGS; aspects of the flood control and water resource programs of the Corps of Engineers; and of course, the meteorological and climatological programs of the USDA. I am not saying that all of these units necessarily must be organized together, but recognition of the environmental unity of the various components, and the absolute need for effective integration must be developed.

There is also need, within this horizontal integration perspective, to monitor and eventually understand how weather and climate impacts human populations as well as our cultural and economic systems. These interactions are mostly within the realms of geography and other social science disciplines. Within NOAA focus on these interactions has only begun to be developed recently, especially at the National Climatic Data Center (NCDC) and at the Assessment and Information Services Center (AISC); both of these centers are units of the National Environmental Satellite, Data, and Information Service (NESDIS), another component of NOAA. These NESDIS units are not in the mainstreams of atmospheric and oceanographic interests of NOAA, and budget reductions, or threats thereof, inhibit the development of effective climate monitoring and information systems at this time.

Within the weather and climate programs at federal and state levels, there is also much need for two-way cooperation and integration between the federal and state levels. My view of the NWS and other NOAA units from the outside, is that they are truly "downward looking" from the federal administrative centers in and around Washington. And unlike the Cooperative Extension Service of USDA there is little direct outreach or service to state and local agencies and the general public, and little opportunity for state and local need to have a fair hearing in administrative centers in Washington.

For climatic studies and informational services to be effective, there is need for data sets and informational services related to environmental, human, and economic systems in each state, or in some cases, groups of states. The primary focus must be non-meteorological, with the exceptions, of course, of the specialized aviation, agricultural, and marine forecasting units. These studies and service centers need to be in each state, so that there is a easy and timely exhange between the centers and the users; most users cannot relate productively to a distant national center. At the same time, a two-way vertical integration of information and services is necessary for a cost-effective overall program, and the two-way exchange could be encouraged by regional centers.

Therefore, with the exception of the forecasting elements of the NWS, a comprehensive integrated program of weather and climate services and studies for agriculture, forestry, physical environments, must be organized from the perspective of inputs and interactions at and near the surface of the earth - and not from the perspective of just the atmosphere. The federal people and the programs concerned about the interactions of energy and moisture at the surface should not be distributed widely among competing federal agencies as they are now. The National Climatic Program Office (NCPO) has been mandated to bring about this horizontal integration among the federal agencies, but its location within NOAA probably restricts the efforts of this office. Vertical integration between the federal agencies and the various states also needs to be nourished, because many of the needed services and studies can be handled most effectively at state or possibly regional levels. Useful models are the federal and state efforts within the Cooperative Extension Services and the Agricultural Experiment Stations of the USDA.

I come to this question with more than twenty years of professional experiences within the weather and climate communities, mostly as a professor of climatology and physical geography at Louisiana State University and Rutgers University with visiting appointments at the University of Delaware, the University of Wisconsin at Madison, and the University of California at Berkeley. I also have worked with the US Forest Service as a forest Climatologist.

In addition to my faculty appointments at LSU in the Departments of Geography/Anthropology and Agricultural Engineering, I serve also as the State Climatologist for Louisiana, and this year as the President of the American Association of State Climatologists (AASC). As a professor and as the State Climatologist, I have received grants and contracts from both federal and state agencies, and my professional experiences range over many aspects of climatology in various professsional capacities.

Florida Citrus Mutual
TELEPHONE (813) 682-1111 · P O BOX 89 · LAKELAND, FLORIDA 33802

BOBBY F. McKOWN
EXECUTIVE VICE PRESIDENT
AND
GENERAL MANAGER

July.3, 1984

JUL 06 1984

Honorable George E. Brown, Jr., Chairman
Subcommittee on Department Operations, Research
and Foreign Agriculture
Committee on Agriculture
U.S. House of Representatives
Room 1301, Longworth Office Building
Washington, D. C. 20515

Honorable James H. Scheuer, Chairman
Subcommittee on Natural Resources, Agriculture
Research and Environment
Committee on Science and Technology
U.S. House of Representatives
Room H2-388, Annex 2
Washington, D. C. 20515

Dear Congressman Brown and Congressman Scheuer:

Florida Citrus Mutual, a voluntary cooperative association whose active membership consists of 13,268 Florida citrus growers, offers the following comments for the record relative to the importance of the continuation of the federal agricultural weather service as well as expanding it to the point whereby it could fully utilize the latest state-of-the-art technology; i.e., weather satellites and dissemination of information by computer.

Florida Citrus Mutual believes and supports the federal frost warning service because these data are vital in the production of citrus within the State of Florida, and we further believe that this program carries one of the highest benefit ratios of any government service.

Florida's citrus and winter vegetable growers have, do and must continue to depend upon timely information from the fruit frost warning service of the vital U.S. Weather Bureau at Ruskin, Florida. We believe that the Ruskin facility has the latest equipment and state-of-the-art capabilities to more effectively utilize the space age weather technology than any other agency or parts of the private sector. Weather forecasting at its best continues to fall short of the desired mark; however, NOAA provides the most cost efficient agricultural weather forecasting delivery system for Florida growers. In fact, we are just now beginning to adopt the satellite technology into better agricultural frost warning weather forecasting. If the Ruskin facility is scrapped, then these technological advances will be stymied and, in our opinion, would severely handicap our growers' productivity.

An agricultural operational weather advisory should seek to provide growers with interpreted weather information that can enable them to make better grove protection-related decisions and thereby increase profits by reducing losses, increasing yields and reducing production costs. It should be viewed as an additional management tool.

The Florida citrus industry consists of predominantly small growers (less than 50 acres on the average) with total acreage of 845,283 acres located in 32 counties. Small growers cannot afford a private weather service. The small budget for minimum temperature and frost warning weather system is cost effective, particularly in the area of energy conservation. Low volume irrigation systems are utilized for frost and freeze protection by citrus growers, particularly when temperatures forecast indicate sustained temperatures below 28° - 26° F for six or more hours. Also, growers of specialty citrus fruit utilize grove heaters for fruit protection. Fuel and labor costs to fire a grove range up to $230.00 per acre/per night. Therefore, timely Ruskin weather forecast updates are economically mandatory in order to conserve fuel, prevent unnecessary firing and determination of proper time for commencing the firing operation.

Small growers also use flood irrigation methods for cold protection; again, energy is an important cost in their management decisions. Without the federal frost warning service for citrus, then, our growers cannot take chances. So they fire, flood, irrigate, etc. without efficiencies. Costs rise, consumers and growers, packers and processors are adversely economically impacted, and all adds to the inflationary spiral. This budget line item is a good and proper use of growers' federal tax dollars. Our industry is not subsidized, nor do we seek price supports, etc.

Florida Citrus Mutual's staff has met with private sector weather services, which desire to give long-range, weekly forecasts with some direct, limited, short term telephone communications. They do not contemplate service approaching the magnitude or precision fo the frost warning service; yet the quoted fees to our association for a two months service (January - February) would be $35,000 - $45,000 for this limited inadequate service.

We have conferred with public broadcasting facilities. They are not interested in providing frequent, regularly scheduled weather forecasts or narratives and they are unwilling to read the forecast in its entirety. It is important that the forecast be received by our grower members without change or editing; because the National Weather Service staff develops narratives explaining the basis for the forecast which are unavailable from other sources.

Public and private organizations are not equipped to handle the demand for weather information.

If we could afford it - and we can't - how could we communicate these data from our collective association to our 13,268 members statewide in a timely manner that would be useful? We can't. The National Weather Service via Ruskin has and can communicate these reports via radio, TV, teletype, etc.

Chairman Brown and Chairman Scheuer, Florida Citrus Mutual supports efficiency and good management practices within all agency/governmental channels. However, we respectfully request that the Congress continue to fund the minimum temperature and frost warning forecasts and provide the agency with a priority management directive in order for the agricultural frost warning weather forecast to continue.

Florida Citrus Mutual has already supported a 50 percent reduction of the number of professional personnel at Ruskin from eight to four meteorologists; furthermore, four staff meteorologists would permit continuing the minimum temperature and frost warning forecasts seven days a week, two shifts per day in lieu of full-time 24-hour service. Minimum temperature and frost warning services are important in pre-freeze preparation and vital in post-freeze evaluation of damage to determine juice loss, fruit loss, etc. To eliminate this vital service would deal a severe blow to an industry that is a linchpin of Florida's economy, and set in motion waves crashing against other indirectly affected industries and services.

The Florida citrus industry is a $2½ billion industry; it keeps 87,000 people gainfully employed on a direct basis and 86,000 on an indirect basis; it is our state's second largest single industry; and provides stability to our state's economy. For each citrus dollar generated, our multiplier effect is $3.06.

Florida Citrus Mutual does not believe the frost forecast service to be a direct support program for a single industry; it benefits all U.S. citizens. The economic well-being of the agricultural industry of Florida is of direct and major importance to hundreds of thousands of employees not only in the fruit and vegetable industries, but also to those whose livelihood depends upon the serving of these industries.

During 1981, 1982 and 1983 the Florida agricultural industry suffered back-to-back devastating freezes and certainly damage would have been far more extensive had we not had the Ruskin Weather Bureau in operation.

Users of agricultural weather forecasts fall into two general groups. The first is the agricultural producer; the farmer, rancher or grower who uses forecasts for daily farm operations and planning. The second group includes the interpreters who combine weather and agricultural information to formulate advisories for use by agricultural producers and agricultural industries which are weather sensitive. The federal frost warning service provides these vital data to our grower members.

In summary, the Ruskin station personnel are of vital importance to the protection of the multi-billion dollar investment Florida growers have in more than 845,000 acres of citrus groves, not to mention the major property values invested in Florida's unique tropical fruit and foliage industries. Florida Citrus Mutual recognizes and appreciates the need to economize in government, but we also continue to believe that after additional evaluation, total abolition of the important fruit frost warning service would be adverse to a major segment of Florida's economy. We respectfully request that you support the continuation of the frost warning service and adequate funding to provide this important service.

If you have any questions, I would be happy to respond.

Respectfully submitted,

Bobby F. McKown
Executive Vice President

McK:vb

PLAINS COTTON GROWERS INC.
515 E. 44th Street P.O. Box 3640 Lubbock, Texas 79452 806/762-0553

Date: July 2, 1984

To: Chairman of the Joint Hearing of the Subcommittee on Department Operations, Research and Foreign Agriculture of the House Committee on Agriculture and the Subcommittee on Natural Resources, Agriculture Research and Environment of the House Committee on Science and Technology - June 27, 1984

From: H. E. Dean, Director of Field Services
Plains Cotton Growers, Inc.

Gentlemen:

Having been unable to attend on June 27 the Joint Hearing of these committees on the subject of agricultural weather operations we take this means to express the interest of Plains Cotton Growers, Inc. and ask that our position be made a part of the record.

Plains Cotton Growers' membership is comprised of cotton producers within a 25-county area of the Texas South Plains. Base crop acreage for cotton in these 25 counties exceeds 4.5 million. In addition, extensive acreages of corn, feed grains, soybeans, wheat and vegetables are also produced. There is no question as to the great value of accurate and timely weather information to a highly concentrated agricultural area such as this.

JUL 06 1984

COTTON
SUPPORTER OF COTTON INCORPORATED

Advancing technology and improved facilities such as weather satellites will no doubt make more detailed and localized forecasts possible. It would be difficult indeed to accurately measure the benefits to agricultural production. Many examples of individual benefits have been outlined by the National Cotton Council in its statement at the hearings. To avoid repetition we will not attempt to enumerate our own list of benefits but instead will simply endorse the statement of the Council.

Because of the diversity between the many areas and crops and the complexity of gathering and dissemination of timely and usable information the federal government must retain the responsibility and provide the leadership in rendering this service. There is no other practical and workable approach.

We believe, however, that because of the universal benefit of agriculture to the people of our nation and to our national well-being, agricultural weather information should be provided without the imposition of a user fee.

We will appreciate your consideration of our view concerning the matter of agricultural weather service and your making our communication a part of the record.

Respectfully submitted,

HE Dean

H. E. (Ed) Dean
Director of Field Services

/j

STATEMENT OF THE AMERICAN FARM BUREAU FEDERATION
TO THE HOUSE AGRICULTURE SUBCOMMITTEE
ON DEPARTMENT OPERATIONS, RESEARCH AND FOREIGN AGRICULTURE
AND
THE HOUSE SCIENCE AND TECHNOLOGY SUBCOMMITTEE
ON NATURAL RESOURCES, AGRICULTURAL RESEARCH AND ENVIRONMENT
REGARDING AGRICULTURE WEATHER OPERATIONS

July 2, 1984

The American Farm Bureau Federation is pleased to offer its comments on the nation's agricultural weather system. Farm Bureau is the country's largest general farm organization with a membership of over three million families in 48 states and Puerto Rico. Farm Bureau members produce every type of commodity grown on a commercial basis in this country. Many Farm Bureau members, particularly those who produce commodities with extreme sensitivity to changes in weather conditions, have benefited greatly from the agricultural weather programs of the National Oceanic and Atmospheric Administration, Department of Commerce.

The importance of agricultural weather service is stressed in Farm Bureau policy. At the 65th annual meeting of the American Farm Bureau Federation last January, voting delegates of the member State Farm Bureaus adopted the following policy regarding agricultural weather:

> "Accurate and timely reporting of weather information is necessary. We support the maintenance and adequate funding of current weather analysis and information dissemination systems and encourage federal, state and private agencies to work to improve these systems. To assure continuity and improvement of these systems, a coordination of user support and federal funds is encouraged. We oppose the sale or transfer of National Weather Service facilities to private industry. Legislation should be enacted to mandate that agricultural weather services be maintained as a federal program with joint planning between the National Weather Service and USDA. Efforts to advance weather forecasting technologies should be concentrated in areas which will benefit crop and cultural management practices."

Emphasized throughout this policy statement is the need for reliable weather information upon which farmers can make sound management decisions. These decisions may involve chemical and fertilizer applications, irrigation, integrated pest management, burning, and special protection for crops and livestock from extreme heat or cold.

The primary benefit of agricultural weather services to farmers should be an increase in net farm income through weather related savings in production costs. For example, aerial application of agricultural chemicals is an expensive part of some farming operations. Without an accurate precipitation forecast, a farmer might waste money and effort by having to re-spray if an unexpected rain occurs. In many instances, agricultural weather services not only helps reduce the costs of production, but can actually save a crop. Citrus is a good example of this. Not only can a citrus grower lose a year's income as a result of an unexpected freeze, but consumer costs escalate and tax revenues are lost because of crop failure. Good agricultural weather services can help avert such disasters.

There are several influences that have brought agricultural weather into the spotlight in recent years. The first influence is the annual decision by the Administration to terminate the agricultural weather programs of the National Weather Service, National Oceanic and Atmospheric Administration.

Just as the Department of Commerce always proposes elimination of the programs, Congress always restores funding to the previous year's level. This see-saw has meant that since FY 1982, the budget for the agricultural weather services in NOAA have been virtually frozen at the 1982 level. The situation has also meant that the groups supporting agricultural weather services must rally each year to their defense. Growers and other users of the agriculture weather services are at a disadvantage because they must contend with yearly funding battles as well as the uncertainty of not knowing whether essential weather services will continue to exist.

The other influence which has focused attention upon agricultural weather was a proposal earlier in the Administration's tenure that would have transferred the nation's weather satellites to private industry. This proposed privatization of weather satellites caused much controversy as well as additional concern by users that the federal weather information data base might become unavailable to them.

Within the constraints of a limited federal budget and Farm Bureau's traditional belief in the limited role of the federal government, Farm Bureau policy clearly states that agricultural weather service should be maintained as a federal program with coordinated user support. The question becomes "what system can best provide reliable service to weather information users with the optimum use of limited tax dollars?". For some, the solution might be to move the agricultural weather system from the Department of Commerce to the Department of Agriculture. Legislation was introduced in the 97th Congress (H.R. 6351) to accomplish this task. While Farm Bureau has no specific policy on such a move, we believe that there should be more cooperation and planning between the Departments of Agriculture and Commerce.

An improved system for agriculture weather service delivery is needed. The proposal by the Agricultural Research Institute entitled "An Approach to A Flexible Agricultural and Forestry Weather and Climate System" was a topic of discussion at the June 27-28 hearings. While Farm Bureau has taken no position on the ARI plan, we believe that the intent behind the plan is good. AFBF believes that efforts should be directed at improving agricultural weather services rather than just maintaining the existing agricultural weather system.

Farm Bureau believes that the Department of Commerce and the Department of Agriculture should review the agricultural weather programs already available and improve coordination of efforts between the involved agencies. The federal government has the technology to provide growers with a good weather information system. This, of course, must be based upon the wise application of dollars and the use of existing resources.

Agricultural weather may be one of the issues considered during discussion of the 1985 farm bill. If so, committee members should discuss the possibility of including provisions that would clarify the roles and responsibilities of the agencies involved in providing weather service.

Farm Bureau emphasizes coordination and communication between components of the agricultural weather system. An improved agricultural weather system is essential to the well-being of American agriculture.

American Association of Nurserymen, Inc.
1250 I Street, N.W., Suite 500, Washington, D.C. 20005 (202) 789-2900

June 27, 1984

Honorable George Brown, Chairman
Subcommittee on Department Operations, Research
and Foreign Agriculture
Committee on Agriculture
1301 Longworth Office Building
Washington, D.C. 20515

Dear Chairman Brown:

On behalf of the American Association of Nurserymen (AAN), I wish to submit the following comments for the record of the hearing on National Agriculture Weather Operations. AAN represents over 3,000 firms in the nursery industry including growers, landscape firms, garden centers and mailorder nurseries.

Weather is a critical element of the formula for the success of a nursery firm. The average citizen is unaware of the role weather forecasting plays in our industry. An important premise, frequently overlooked, is that nursery products are crops much like wheat and corn in that we have planting, seeding, growing and harvesting seasons. When we plant, spray, irrigate or harvest depends on weather forecasts. A wrong forecast can result in delays that extend beyond the end of adverse weather conditions. A grower who fails to accurately forecast the onset of winter conditions can, in effect, lose the entire winter.

In the nursery business many young plants are dug in the fall. This enables the growers to grade, size and bundle plants at a time when business is slow and labor is plentiful. If the digging must be postponed until spring, such activities must be squeezed in during the grower's busiest season. Further, the grower digs up the bulk of his field grown crop in the early spring in time for shipping to retail outlets. Again, it is important for the grower to be ready to get in the fields at the first sign of good weather. If the grower is delayed, plants enter their growth cycle. At that point the grower generally must wait to harvest at the end of that growing season. Digging plants at the completion of the first "flush" of growth is more costly and can only be done with special precautions. The losses from such delays are obvious, retailers will look to other suppliers for production, crews will have to be maintained and cash flow and profitability will suffer.

The retailer such as the garden center is also dependent on accurate, useful forecasts. Our industry is, unfortunately, very dependent on warm sunny spring weekends for consumer demand to be at its peak. Advertising programs and staffing requirements are all geared to weather forecasts.

Likewise, landscape firms bid on projects based on projections of time necessary to complete a project. Extra crew days can quickly eat into the profit margin of these small businesses.

Discover
The Pleasure
of
Plants

The need for accurate forecasts was dramatically and tragically reinforced by the "freeze" which occurred this past winter in parts of the South, particularly Texas. Also, as this growing season advances we are finding plants from the Northwest thought undamaged were severely damaged. In the Mid-west and East plants planted last spring not yet recovered from the shock of transplanting were injured and many, under landscape guarantee, must now be replaced at landscape firms' expense. Millions of dollars of living plant material were destroyed by the freeze, much of which could have been saved with adequate advanced notice. There are measures which can be taken to reduce or avoid the damage inflicted by a freeze..e.g. A grower can move container plants into temporary plastic greenhouses, mass the plants to reduce cold penetration, or when massed, the plants can be covered with a thermal blanket of special insulating foam material. Further, the industry could pass along such forecast information to customers to minimize their losses from such freezes. Our concerns about weather forecasting also go beyond production. Not all plants can survive under all conditions. Long term forecasts will help ensure the grower will be able to provide an adequate supply of plants to meet the changing environments in which they will be placed.

The information we need is not complex but is more than the general public requires. The range of conditions or temperatures are as important as the averages. For example, the freeze of December wasn't the coldest freeze ever experienced but the rate of change, range of temperatures and the duration of the freeze created the great losses suffered by the industry.

Better control of our production will also influence consumer prices. Loss of material and delays in production place add pressure on the cost of doing business which generally translate into price increases.

We believe there is a tremendous vacuum which the federal government, with the help of local and state governments, can fill. We need immediate funding of a coordinated comprehensive program. We need regional cooperation to ensure information which will be useful to a particular location. We also recognize the need for a government-private sector partnership. Finally, we need an extensive campaign to ensure that such information finds its way to the business person. Too frequently we overlook the necessity to create the linkage with the end user.

AAN endorses the concept of a national system as outlined in the January 1984 report by Agricultural Research Institute, entitled "An Approach to a Flexible Agricultural and Forestry Weather and Climate System." We believe it provides the blueprint for a realistic and productive solution to a serious problem.

We thank you for the opportunity to present our views on this subject. We hope we have been able to convey the importance of weather forecasting to one of the many diverse elements of the agricultural community. Please call upon us if we can be of assistance.

Sincerely,

John S. Satagaj
Director of Governmental Affairs
and Staff Counsel

JSS:lkh

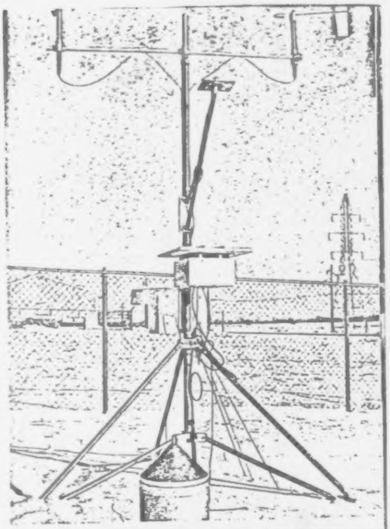
ARTICLE SUBMITTED BY

Norman J. Rosenberg
George Holmes Professor of Agricultural Meteorology and
Director, CAMaC
University of Nebraska, Lincoln
Lincoln, Nebraska 68583-0728

Farming *with* Pride

Winter 1984

Vol. 4 – No. 1



The Changing Direction in Weather Information

The University of Nebraska in Lincoln has developed a practical network that provides farmers with timely, accurate weather information for making management decisions. In fact, this network may become a model for other states to follow 4

Unique Dairy Farm Project Beats the Energy Squeeze

A New York dairy farmer is cooperating with Cornell University in a comprehensive project that may become a useful guide to help other dairy farmers cut energy costs considerably 12

How Pride Screens Corn for Standability

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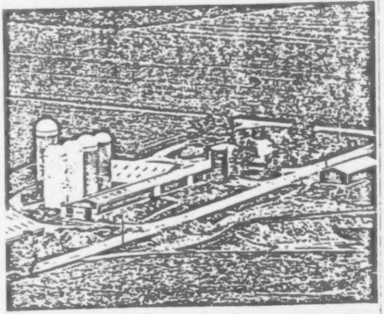
Pride's Ongoing Corn Research Fulfills Conservation Tillage Needs

Pride recognizes the importance of developing corn varieties that perform well under conservation tillage practices. For a progress report, turn to page 18

Women for Agriculture

Numerous farm women groups are active in legislation, regulations, education, promotion, and consumer issues. Learn what some of these key groups are accomplishing and how they're helping to preserve the family farm 22



Publisher
Janice Johnson
Editor
Karl Ohm III
Contributing Editor
Pete Millard
Art/Production Director
Greg Ohm

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On the Cover:

Before radar and other electronic devices, this stoutly perched rooster weather vane was commonplace hardware on many farms. The vane swiveled when the wind changed direction and helped farmers sharpen their forecasting wit. Today, weather forecasting involves a variety of skills, and our leadoff story looks at a novel ag weather information program in Nebraska.

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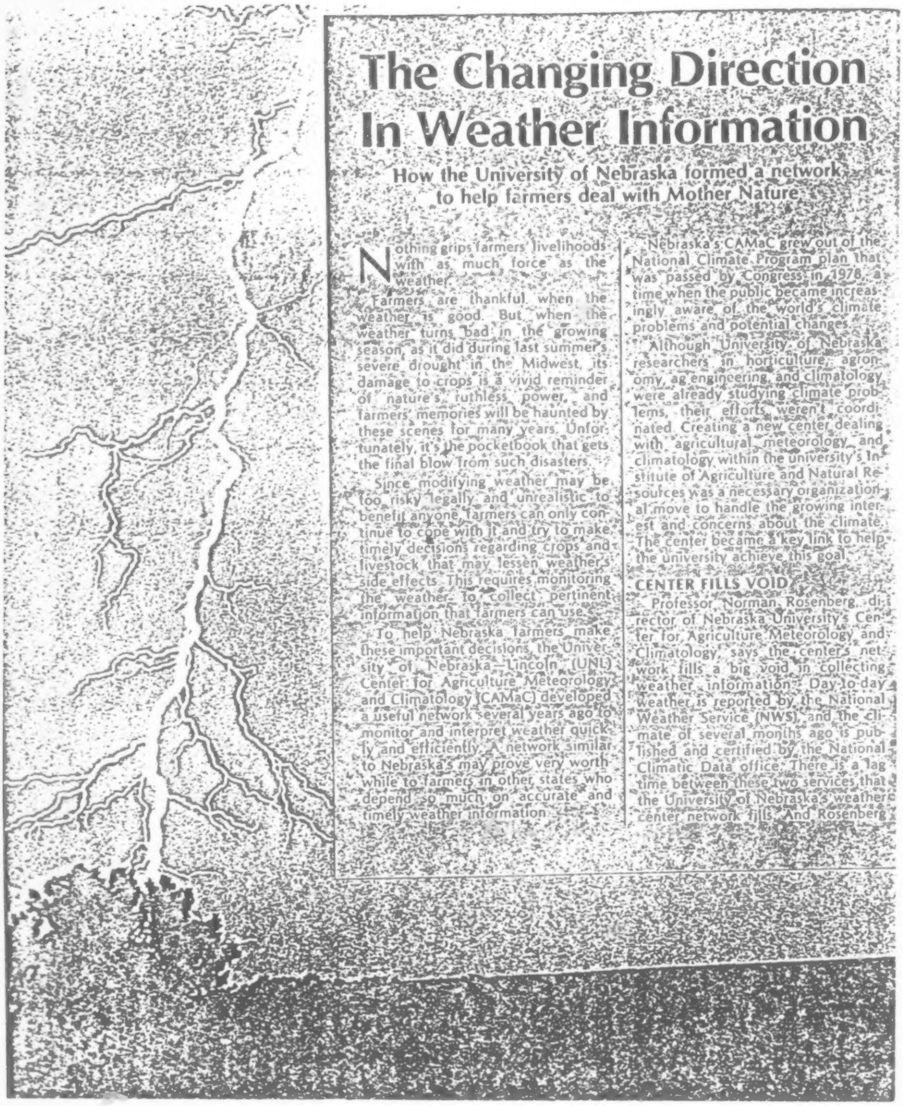


The Changing Direction In Weather Information

How the University of Nebraska formed a network to help farmers deal with Mother Nature

Nothing grips farmers' livelihoods with as much force as the weather.

Farmers are thankful when the weather is good. But when the weather turns bad in the growing season, as it did during last summer's severe drought in the Midwest, its damage to crops is a vivid reminder of nature's ruthless power, and farmers' memories will be haunted by these scenes for many years. Unfortunately, it's the pocketbook that gets the final blow from such disasters.

Since modifying weather may be too risky legally and unrealistic to benefit anyone, farmers can only continue to cope with it and try to make timely decisions regarding crops and livestock that may lessen weather's side effects. This requires monitoring the weather to collect pertinent information that farmers can use.

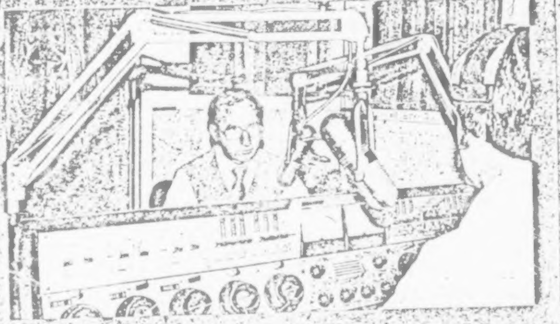
To help Nebraska farmers make these important decisions, the University of Nebraska–Lincoln (UNL) Center for Agriculture Meteorology and Climatology (CAMaC) developed a useful network several years ago to monitor and interpret weather quickly and efficiently. A network similar to Nebraska's may prove very worthwhile to farmers in other states who depend so much on accurate and timely weather information.

Nebraska's CAMaC grew out of the National Climate Program plan that was passed by Congress in 1978, a time when the public became increasingly aware of the world's climate problems and potential changes.

Although University of Nebraska researchers in horticulture, agronomy, ag engineering, and climatology were already studying climate problems, their efforts weren't coordinated. Creating a new center dealing with agricultural meteorology and climatology within the university's Institute of Agriculture and Natural Resources was a necessary organizational move to handle the growing interest and concerns about the climate. The center became a key link to help the university achieve this goal.

CENTER FILLS VOID

Professor Norman Rosenberg, director of Nebraska University's Center for Agriculture Meteorology and Climatology, says the center's network fills a big void in collecting weather information. Day-to-day weather is reported by the National Weather Service (NWS), and the climate of several months ago is published and certified by the National Climatic Data office. There is a lag time between these two services that the University of Nebraska's weather center network fills. And Rosenberg



Ken Hubbard (left), University of Nebraska climate resource specialist and one of two climatologists on the university's agriculture climate situation committee is recording a weather advisory for farmers. The taped message is distributed to 20 Nebraska radio stations every Monday during the growing season. Nebraska's daily and weekly newspapers also receive the weather advisories. Craig Derscheid, a University of Nebraska ag communications specialist, is behind the control panel.

says the center's information is vital to farmers. [Editor's Note: The National Weather Service (formerly the National Weather Bureau) and the National Climatic Data office come under The National Oceanic and Atmospheric Administration (NOAA) within the Dept. of Commerce.]

"In most states, one (NWS) meteorologist has been told to be the agriculture specialist," says Rosenberg. "He doesn't have the necessary expertise to really evaluate all of this information and put it in terms that are helpful to farmers. There are a few locations in the nation where NWS has set up groups that are strong, such as Purdue University, Auburn University, and College Station, Texas (Texas A & M University), but they are vulnerable to budgetary constraints.

"Agriculture just doesn't get a great deal of sustained support from the National Oceanic and Atmospheric Administration. It goes up and it goes down. Usually, when there is a budget crisis, agriculture weather services take it on the chin. So, NOAA has really not provided a nationwide agriculture support service, and I don't think it ever will.

"That's why it's incumbent on the states and regions to develop their own support systems." And frankly speaking, the state (land grant) universities have far more expertise than the NWS."

Rosenberg also says the NWS offices are undermanned and don't have the necessary agricultural experience to give most farmers the weather information they need. Rosenberg considers NWS staff meteorologists highly qualified and competent, but he says they don't have time to run an ag weather service comparable to what exists in Nebraska.

COMPUTERIZED INFORMATION

One of the first areas that Nebraska's CAMaC examined was using irrigation systems more efficiently.

Nebraska irrigates nearly eight million acres each year, resulting in high energy costs to pump groundwater. So much irrigation has also lowered groundwater tables and caused environmental problems, such as minerals leaching into the groundwater. Commercial companies and university extension specialists were helping farmers determine proper amounts of water and timing of irrigation applications. The weakness in these programs was the quality of weather information.

This lack of quality weather information prompted the center to work with NOAA's National Climate Program office to provide a weather network to support irrigation and other agricultural operations. The Center for Agriculture Meteorology and Climatology with funding from the National Climate Program purchased automated weather data

Photo courtesy of University of Nebraska—Lincoln Ag Communication Dept equipment and tested it in 1980. By the spring of 1981, the network was operating. This network automatically collects hourly weather information from monitoring stations across the state. These stations make up the university's Automated Weather Data Network—AWDN, for short.

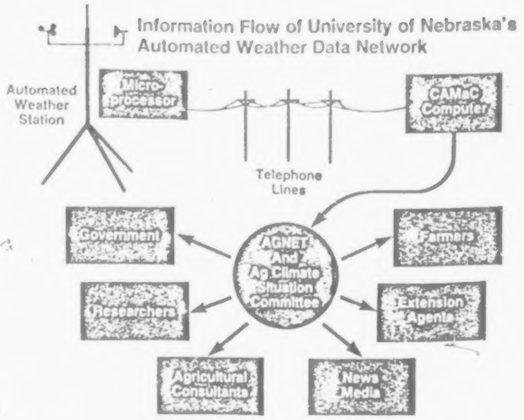
Originally, four of the five weather reporting or monitoring stations were located in southwestern Nebraska, an area where irrigation was widely used and that greatly depended on groundwater from the Ogallala aquifer. The stations were spaced 70 miles apart, forming a nearly uniform grid. Today, there are 17 stations in Nebraska, three in South Dakota and one in Colorado that feed weather data to Nebraska's CAMaC network.

A complete weather station has several instruments attached to a 10-foot tower (see photo on page 7). The instruments measure wind speed and direction, the air temperature, relative humidity, global radiation, soil temperature, and precipitation. Each station also has a microprocessor that records information and serves as a communication device. This microprocessor monitors signals from the instruments each minute. From these values, hourly averages are calculated. The hourly totals are then stored in the microprocessor's memory bank.

To complete the collection process, a computer at CAMaC automatically controls a telecommunication link with the remote weather stations and calls daily at 3 a.m. to gather the information. This technology allows the university to complete its collection job very quickly and eliminates the need to manually record and process the information.

Once the information is collected from these stations, it is then relayed to a computer system known as AGNET. Many Nebraska farmers already tap into the AGNET system that offers a variety of computer programs, such as marketing and finance, crop and livestock production, and grain handling. Weather-related programs, such as irrigation scheduling and grain drying performance, are available to farmers through the university's AGNET computer system.

Information collected from these automated stations is also used by the university's extension agricultural climate situation committee to help farmers make management decisions.



Information Flow of University of Nebraska's Automated Weather Data Network

Once weather information is collected by the automated stations located across Nebraska, it is sent to a CAMaC computer and then transmitted to the AGNET computer information service and the university extension ag climate situation committee. AGNET and the situation on committee are separate methods of distributing weather information to farmers, news media, extension agents, ag consultants, researchers, and both state and federal government agencies.

The AGNET system and the agricultural climate situation committee are two separate methods of analyzing and distributing pertinent weather information (see chart above), and both provide a key service that farmers don't get from the National Weather Service or the local radio or television meteorologist.

AGNET'S ROLE

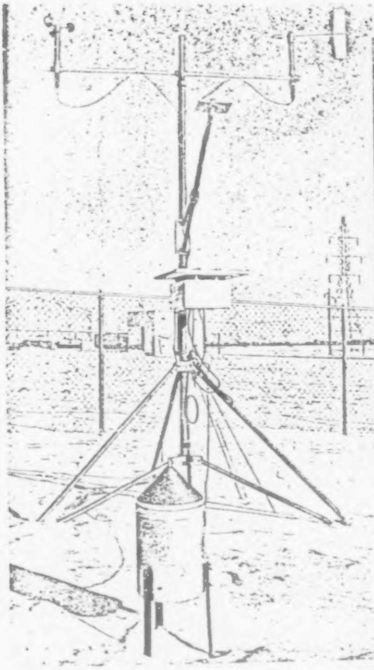
Weather information collected by the automated weather stations is used in AGNET computer programs for scheduling irrigation, estimating crop development rates, estimating energy requirements for grain drying, and predicting livestock weight gains. Other AGNET weather-related programs that are near completion include scheduling fertilizer applications, the time of pesticide applications, and analyzing weather's stress on crops and livestock.

The AGNET computer program that estimates crop development rates is called CROP STATUS. Developed by Ralph Neild, a UNL climatologist and the ag climate situation committee founder, the program allows farmers to estimate frost probability and harvest dates based on growing degree days and other weather information up to the day that the farmer asks for the information.

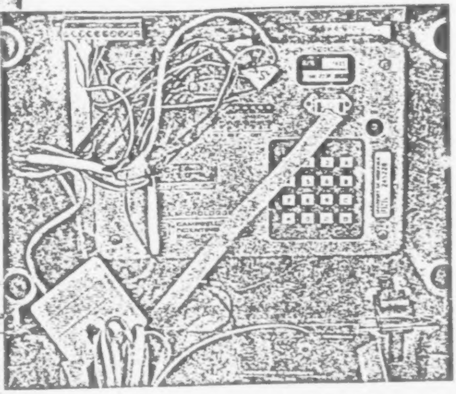
The grain drying AGNET program, called BIN DRY, uses temperature and relative humidity figures. Farmers can use up-to-date weather information to project the moisture and temperatures in the bin and to determine the airflow they need to generate that day. It also includes layer drying information. If a farmer fills his bin to 25% of its capacity, the computer tells him how fast the grain is drying and how soon he can load more on top.

In the livestock management area, the most popular AGNET program is called BEEF. This program looks at the heat balance of feeders and projects the amount of feed the animal needs for body maintenance and productive weight gain. The program is based on feed rations, economic factors, and weather information, such as temperature, relative humidity, wind, and the windchill factor.

Although AGNET programs range from listing the hourly and daily weather factors in a specific region, estimating crop development, frost probability and determining harvest



There are 17 automated weather stations (like the one shown at left) located across Nebraska, collecting weather data that is transmitted to the University of Nebraska–Lincoln Center for Agriculture Meteorology and Climatology (CAMaC).



A microprocessor (above) stores weather information and enables a computer at CAMaC to retrieve the data automatically via telephone lines.

dates based on growing degree days and climatic conditions, the most widely used programs among Nebraskan farmers are the ones on irrigation.

Thomas Thompson, AGNET supervisor and UNL ag engineer, explains that once the Automated Weather Data Network became a reality, it greatly increased the effectiveness of scheduling irrigation.

"Clearly, the best example of how AWDN expanded our ability would be irrigation scheduling," Thompson says. "We had an irrigation program on the AGNET system before, but then we would require the farmer to collect his own weather data or get it locally. Every time a farmer ran the program, he would have to enter that data. Now all he has to do is enter the data relating to his field."

Farmers still have to measure rainfall because there is too much variation in readings among the automated weather stations. Thompson says that because the stations can record solar radiation and wind speed, AGNET offers a more accurate method for estimating water use by crops.

AG CLIMATE COMMITTEE

The second method of delivering weather information to Nebraska farmers involves the university's agriculture climate situation committee.

Ken Hubbard, who is one of two climatologists on the committee and manages the Automated Weather Data Network, says the drought of 1981 made farmers more aware of the ag situation committee's value by answering questions on crop conditions.

The committee, which was formed in 1981, is part of the cooperative extension service and receives weather information from the AWDN every Monday afternoon during the growing season. After reviewing the information and discussing what it means to the state's farmers, the committee issues advisories that are distributed by 55 state newspapers, 20 radio stations, and an extension television program called Farm and Ranch Review.

The committee is made up of meteorologists, climatologists, agronomists, soil scientists, plant pathologists, entomologists, a rangeland specialist, a forester, an animal scientist, a veterinarian, and a journalist who is responsible for condensing the committee's advisory information and releasing it to the state's newspapers and radio stations.

When the committee meets, Neild summarizes what he feels are the most pressing problems of the week based on weather information and the crops' stage of growth. Other specialists on the committee then react and offer opinions. The committee also taps into other information sources, such as the Weekly Crop Weather and Crop Bulletin, and the Monthly and Seasonal Weather Outlooks produced by NOAA and USDA. The committee also uses information provided by the Nebraska Climate Resource Office as reference materials.

Before the ag climate situation committee and the Automated Weather Data Network were created in Nebraska, Neild says there was no forewarning or forecasting on what kind of damage might result when a serious weather problem developed. By the time the information was collected and analyzed, specialists were responding after the fact. Today, specialists are working with daily data provided by the automated weather network, and the committee can make an immediate and unified appraisal. "We are much more objective than we used to be because we have an ongoing weather monitoring system," says Neild.

The AWDN, the ag climate situation committee, and AGNET provide a clearer picture of what the weather is doing throughout the state and can pinpoint local conditions. Again, before the network was operational, Hubbard says a farmer could go to the state ag statistician, the National Weather Service at the Lincoln airport or call somebody in the horticulture department for weather data. Depending on the nature of the data, farmers would receive a different picture from each source. With the weather information now being collected under one roof, more accurate and uniform advisories can be sent out to the farmers.

David Keith, a Nebraska extension entomologist who has served on the committee since it began, says the farmer wants to look at the total picture of how weather will affect crop and livestock production and not just pieces of the puzzle.

"The committee has also increased communication among the agricultural specialists in the state," Keith says. "And our job is to get useful information out to the farmer on what he should do about these weather-related problems."

An illustration of how the committee interacted and helped provide information to Nebraska farmers was the corn borer outbreak that occurred last growing season in some areas of the state. Hubbard says this event was an eye opener for him because the cold, wet spring delayed hatching of the corn borer's eggs. Hubbard also points out that most corn is resistant to corn borer when it first breaks through the ground. But since egg hatching was delayed, the corn lost some of its resistance. The weather

Thomas Thompson, a University of Nebraska – Lincoln ag engineering professor, supervises the AGNET computer information system that covers a wide range of programs for farmers.

Forecasting daily weather with a personal touch for farmers

Although Nebraska's computerized weather collection network enables information to be analyzed more quickly, it is still professional people who ultimately explain weather information to others.

When meteorologist Marv Holewinski, who owns a two-man weather service operation called Weather Time, Inc., near Middleton, Wis., decided to develop a report intended for farmers, his decision was based on more than the simple fact that farmers had a vested interest in the weather. Holewinski grew up on a farm and says few forecasters know what farmers want. He claims to give farmers the information they need for their everyday farming decisions, but he admits that he is handicapped because some information is simply not available on a daily basis.

There is no question, according to Holewinski, that the automated weather data network is useful, especially for irrigation scheduling.

The big problem in forecasting is that the number of observation stations has remained constant since the early 1960s. Holewinski says there are less than 300 stations that actually take different readings in the atmosphere. In the Midwest, he says there are stations in Green Bay, Wis., St. Cloud, Minn., Peoria, Ill., and Des Moines, Iowa. These stations form a grid roughly 400 miles apart. Holewinski stresses that if the National Weather Service wants to improve short-range forecasting accuracy, it has to increase the number of stations and tighten the grid. But this is unlikely to happen, he adds.

Even with these information drawbacks and his inability to use a network similar to what exists in Nebraska, Holewinski has built a career and sturdy reputation on his ability to get the weather message across to specific audiences. A large measure of Holewinski's success hinges on the farming population in Wisconsin and northern Illinois. Farmers in these areas hear Holewinski's daily reports on a network of 25 radio stations. After talking to his audience at farm shows and redesigning his created a much more serious problem than people anticipated in the beginning.

The committee's advisories that followed the first brood corn borer outbreak urged farmers to react. Consequently, a lot of acres were treated for corn borer.

After the weather finally returned to normal late in the spring, dry weather followed and completely shifted the ag climate situation committee's focus. Questions surfaced about drought conditions and how would the decisions made earlier in the growing season affect harvesting dates.

"Nebraska farmers really started paying attention to this committee during the drought by following the newspapers and radio reports to get the latest information," Keith says. "Relative to the corn borer, they asked if they should harvest early to avoid stalk breakage. There was also a lot of concern about the stalk rot that came near the end of the season. Because of the dry weather in the middle of the growing season and the borer infestation, they asked if stalk rot would get worse."

Near the end of the season, a recommendation that early harvest was "highly advisable" was repeated weekly because of the insect problem, stalk rot outbreak, and likelihood of an early frost, according to plant pathologist David Wysong, who is a member of the ag climate situation committee. Farmers listened to the advisories and benefited by acting early, he says.

FUTURE PLANS

Various specialists taking part in the committee's decisions enhance the university and the extension's ability to pinpoint trouble spots and offer options to the farmer. And that is precisely the purpose of the situation committee, says UNL agronomist and ag climate situation committee member Don Hanway.

An area that Hanway hopes the committee can deal more effectively with in the near future is fertilizer application. Right now, the inability of the weather network to report the actual soil moisture prevents the committee from upgrading its current advisories on applying fertilizers.

"It would be nice to do this, and that's why we want to get actual soil moisture data so that we know the actual soil moisture prior to planting," Hanway says. "If we know something about the moisture prior to planting, then you can make some fertilizer recommendations, at least on the dryland crops.

"Since we don't have a system to determine soil moisture, we use the cumulative amount of precipitation at various points around the state. We try to advise farmers on how much to apply on certain crops. When the soil is real wet, as it has been here during the last couple of springs, we warn farmers about the leaching problems involved with side-dressing nitrogen."

The overall impact of AWDN, the AGNET weather-based computer programs, and the ag climate situation committee has produced results for Nebraska agriculture, according to Neild, even though the program is still considered new.

University of Nebraska researchers are still improving weather collection methods and information delivery systems. For example, a system called "Agrivis" has been developed that displays summarized weather information on crop water use at the bottom of a television picture. AGNET is also expanding and developing computer programs on soil moisture and pest development. As computer technology becomes more widespread, farmers will have more valuable weather information right at their fingertips. ☐

Meteorologist Marv Holewinski, Middleton, Wis., broadcasts "ag weather capsules" to farmers in Wisconsin and northern Illinois. These capsules are frequently updated throughout the day.

forecast for farmers, Holewinski recently started "ag weather" capsules.

"Not many forecasters have farming experience, and I think that's why you don't see many agriculture reports," Holewinski says. "Another thing is that many meteorologists do not communicate well or put their scientific knowledge into useful terms for farmers.

"We tell farmers how to look out for their operation. During the haying season, for example, if there is a rainy trend developing we let them know. If it looks like there will be one or two weak funnel systems going through the area during the next three- to five-day period, we let farmers know the chance of rain will be spotty, leaving a quarter inch or less.

"The fact that I have farming experience gives me some confidence to say, 'If it was me, I'd probably cut quite a bit of hay.' I'll tell farmers to plan on harvesting hay three days in a row versus cutting down only a few acres and waiting to see how the weather turns out."

During the winter months, Holewinski says he keeps track on frost depths and regularly reports how dry or moist the soil is below the frost layer. In the spring, he watches the frost layers and reports how much moisture is seeping into the ground. When harvest time arrives, Holewinski turns his attention to drying conditions.

Holewinski operates his weather service from his rented farmstead home. He receives most of his information from a computer terminal hookup with a firm in Boston called Weather Services, Inc. Weather Services gets its information from the National Weather Service and processes the data to suit the needs of subscribers like Holewinski.

California Farm Bureau Federation
1601 Exposition Boulevard • Sacramento, CA 95815 • Telephone (916) 924-4000

July 26, 1984

Mr. Skip Stiles
House Agriculture Committee
1301 Longworth
House Office Building
Washington, D.C. 20515

Re: June 27-28 Oversight Hearing
Agricultural Weather Services

Dear Skip:

In September of 1983, the California Department of Food and Agriculture organized a task force to address the needs of the agricultural industry for weather information. One of the first goals of the task force was to investigate the needs of growers for weather forecasting services.

The enclosed survey was prepared and sent to members of California Farm Bureau Federation Commodity Advisory Committee members, U.C. Extension Farm Advisors, NWS meteorologists, professional Agricultural Production Consultants, grower names provided by the University of California, and subscribers to a private weather firm called Nowcasting. The preliminary results of the survey are summarized for your information. The final report should be available in October.

In addition to the significant amount of information that can be provided by the survey results, this endeavor has given us experience in cooperating with a broad range of entities. Participants included the University of California, California Department of Food and Agriculture, California Farm Bureau, Raising, Walnut, Prune Advisory Board, California Association of Professional Agricultural Consultants, National Weather Service, and Nowcasting.

I hope this information is useful to the committees in their deliberations and can be incorporated into the hearing record.

Sincerely,

Gail/sr

GAIL UFFORD DAMIANO
Program Director
Commodity Services Division

GUD:ms
Enclosure

This list was put together from the following rosters:

1) Fruit Frost Task Force attendees

2) 1976 - 1982 Letters Received by NWS or us

3) NWS/Ag & Fire Weather Program Meetings held by California State Senate

4) Respondants to ag weather survey (CAC members)

5) CFBF Agricultural Weather Committee

6) Attendees at CDFA Weather meeting August 16, 1983 (formed CDFA task force from this meeting)

7) Fruit Frost Program financial contributors

8) Names from University of California used for ag. weather survey (not all responded or agreed to be used, therefore this list was kept seperate for editing down only to those respondents answering affirmatively on last question)

To avoid duplicative mailings, all names are listed once, with numbers corresponding to the above key noted at the right. The entire list was used in mailing out the request from Henry Voss to write for the 6/27-28 congressional hearing. It has been sent to the CDFA Task Force and should come in handy in future agricultural weather activities.

TABLE I

Primary commodities

Livestock		Fruits & Vegetables	
Beef	13%	Avocados	9%
Dairy	3%	Citrus	15%
Fish	1%	Other Fruit	31%
Horses	2%	Grapes	21%
Poultry	1%	Nuts	25%
Sheep	3%	Tomatoes	11%
Swine	1%	Other Vegetables	13%

Field Crops		Other	
Cotton	15%	Bees	2%
Dry Beans	11%	Flowers	3%
Feed Grains	15%	Plants	5%
Hay	19%	Timber	1%
Rice	9%	Other	6%
Sugar	5%		
Wheat	9%		

TABLE II

How do you use weather information in your occupation?

	Current use	Would like to use	Total Interest
Irrigation timing	57%	13%	70%
Pest management	57%	14%	71%
Chemical applications	68%	9%	77%
Frost protection	58%	5%	63%
Labor scheduling	38%	5%	43%
Crop models	8%	11%	19%
Harvesting	65%	8%	73%
Planting	54%	6%	60%
Burning	45%	3%	48%
Transportation planning	12%	3%	15%
Animal breeding	3%	1%	4%
Animal movement	10%	1%	11%
Animal marketing	6%	2%	8%
Environmental modification	9%	5%	14%
Research	14%	7%	21%
Statistics	11%	8%	19%
Financial/risk assessment	13%	11%	24%
Data collection	11%	9%	20%
Data dissemination	7%	6%	13%
Forecasting	26%	13%	39%
Other	2%	1%	3%

TABLE III

What weather information do you currently work with or would like to have?

	Currently	Would like to get	Total Interest*
Rain - intensity	65%	21%	86%
- timing	64%	22%	86%
Air temperature			
- maximum/minimum	67%	11%	78%
- mean or average	32%	14%	46%
Wind - speed	51%	19%	70%
- direction	43%	17%	60%
- timing	36%	22%	58%
Fruit frost	51%	8%	59%
Dewpoint	38%	11%	49%
Dew deposition	11%	11%	22%
Relative humidity	35%	15%	50%
Radiation	11%	14%	25%
Cloud cover - timing	18%	18%	36%
- duration	14%	18%	32%
Burning conditions	39%	9%	48%
Snowpack and runoff	16%	7%	23%
Hail	16%	18%	34%
Soil temperature	20%	26%	46%
Soil moisture	17%	24%	41%
Evapotranspiration (ET)	25%	28%	53%
Other	1%	1%	2%

TABLE IV

How do you receive weather information and how would you like to receive it?

	Currently received	Would like to receive via:	Total Interest
Television	82%	2%	84%
Radio	86%	2%	88%
Newspaper	55%	1%	56%
Continuous weather radio (NOAA)	46%	13%	59%
Telephone recording	47%	12%	59%
Computer	7%	21%	28%
Own equipment	14%	6%	20%
Other	7%	2%	9%

TABLE V

When do you prefer to receive weather information?

Early morning	55%
Noon	18%
Early evening	44%
Other	5%

TABLE VI

What agency or entity is the main provider of the weather information you receive?

National Weather Service	86%
Cooperative Extension	9%
Grower association	9%
Agricultural Commissioner	3%
Private industry	16%
Other	13%

TABLE VII

Would you be willing to participate in future surveys or other activities on this subject?

Yes	92%	No	8%

NOAA reprint
National Oceanic and Atmospheric Administration
VOLUME 12 NUMBER 1 WINTER 82

Weather Services And The Nation's Economy

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Weather Services And The Nation's Economy

Don Witten

The life-saving role of severe weather warnings undoubtedly is valued by anyone who has been threatened by a tornado, hurricane, blizzard, or flood.

The day-to-day utility of routine weather forecasts is appreciated by the millions of Americans who used the information to make decisions like whether or not to carry a raincoat to work or shopping.

But it is questionable if many people realize the economic worth of accurate weather forecasts as applied daily in such industries as farming, fishing, and ocean transportation. Such forecasts, when used with other information, help keep production and operating costs down, factors ultimately reflected in lower consumer prices.

The hub of the Nation's weather information collection, processing, prediction, and dissemination operations is NOAA's National Weather Service. Each year, the Weather Service issues more than two million meteorological forecasts and warnings. Thousands of television and radio stations, newspapers, private meteorologists, and other users all over the country utilize this information.

Most of the National Weather Service's forecasts are prepared and disseminated as localized products by the more than 300 weather offices throughout the United States. Many of these offices disseminate additional climate and weather information which, when used with the forecasts, provide a valuable tool for the farmer, fisherman, and sailor in making their daily decisions.

According to Paul Llanso, Weather Service Agricultural Weather Program Leader, "Weather information has always been important to farmers. But it becomes most significant when mated to the results of research in agricultural production. The applied forecasts and operations advice give the farmer key inputs for decisionmaking.

"The end result is greater production efficiency and lower costs for the farmer," added Llanso," keeping our food affordable and available."

Research at NOAA's Agriculture Weather Service Center, Stoneville, Miss., in cooperation with local universities, produced one computer model now used by over 2,400 rice growers farming 588,000 acres in Louisiana, Arkansas and Mississippi.

Gene Rench, Meteorologist-in-Charge of the NOAA Center in Stoneville, said that use of the model and forecasts has increased rice yield ten bushels an acre for the participating farmers. This, he noted, accounts for the 14 percent increase in rice grower participation over the past year, with a corresponding increase of 58 percent in total acreage.

The rice production model is based on the fact that rice plant growth is highly correlated to the average daily temperature above 50 degrees Fahrenheit. Here is how it is put to work: Participating farmers notify county agents at the time the rice plants first emerge from the soil. The agents then give this information to NOAA, where it is processed and used as a basis to develop forecasts for individual crops. These forecasts include the time the crops will reach critical stages of development. Armed with this information, the farmers can best decide when to irrigate, flood the fields, control pests and weeds, and even when to schedule harvest.

"Our program is operating in a region which grows two thirds of the U.S. rice crop. I foresee expanded benefits which could ultimately play a significant role in world food production," said Rench.

The dramatic increase in the cost of fuel and oil-based fertilizers and herbicides in recent years has enhanced the value of accurate weather forecasts to the farmer. Now, more than ever, they must make the most economical use of these expensive products in their operations.

The weather can determine the best timing for chemical spraying because certain products often depend upon conditions at that time. Some herbicides, for example, require rain or other moisture to be activated. Pesticides, on the other hand, become less effective when diluted or washed away by rain.

"Weather forecasts save U.S. farmers at least $750 million a year in the production costs of the major commodities such as corn, wheat, soybeans, cotton, and fruit," said Professor James E. Newman, extension climatologist at Purdue University, Lafayette, Ind.

"Michigan's fruit industry uses the weather information to eliminate two to three pesticide sprays a year, saving at least $4 million," said Ceel Van Den Brink, Agri-

cultural Meteorologist at Michigan State University, East Lansing.

This year, Michigan harvested fruit from 125,000 acres of trees including apples, cherries, pears, plums, and peaches. The State is the tart cherry capital of the world, and usually ranks third in the Nation for apples of all kinds.

Accurate forecasts of minimum temperatures also are as vital to the Florida and California fruit grower as they are to the asparagus farmer in Illinois when it comes to cold weather. With 24 to 36 hours advance warning of frost or freezing weather, these farmers can harvest early to save their crops.

Reliable cold weather warnings not only save crops, but they help conserve diesel fuel and electricity for heaters and blowers by indicating when they are needed to ward off the frost.

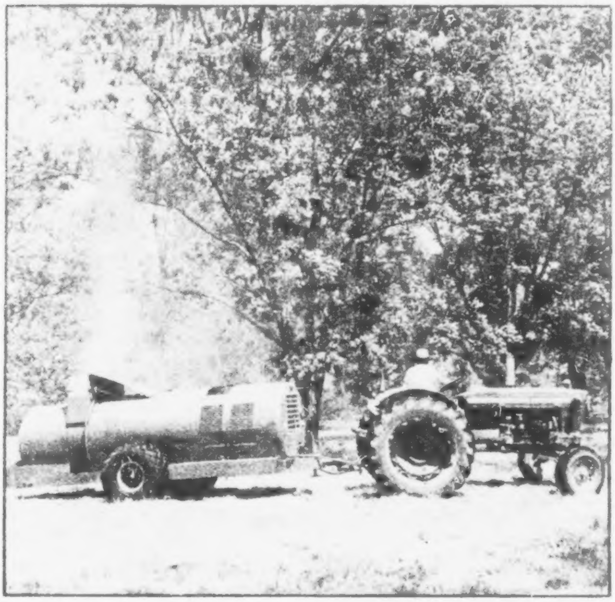
In Maine the fight against the potato blight is aided by a computerized system that tracks the temperature and wetness of the potato field. This data makes it possible to provide more accurate predictions of the blight, a disease related to excessive temperature and humidity. Consequently, there are fewer unnecessary and precautionary applications of expensive pesticides today than in the past.

Predictions of low temperatures have proved valuable to potato transporters. "It has been estimated that at least $100,000 dollars was saved last year, in Maine, when potato bruising was curtailed," according to Augie Sardinha, Agricultural Meteorologist at the National Weather Service office in Portland.

"Potato 'bruises' occur when they are exposed to freezing conditions," Sardinha explained. "Now, transporters can know when to use covered troughs to protect potatoes which are being trucked to processing plants," he continued. "The total savings to the transporter could reach $500,000 next year as more farmers use this piece of weather information," he added.

Weather forecasts help save energy and money in other ways. With advance notice of a coming rain, a farmer might decide not to irrigate, saving electrical costs of running the water pumps. Timely weather forecasts also help farmer eliminate unnecessary tractor trips to the crop fields, conserving many gallons of precious fuel. A field in need of cultivation, for example, often can wait a few days when the farmer knows that it is going to rain. Knowing that it will rain, saves the energy used in eliminating weeds that would only spring up days later.

Accurate, fast weather services are critical to agricultural activities such as harvesting (opposite page) and spraying (below).



The Waialua Sugar Company on the island of Oahu in Hawaii credits meteorological forecast information with saving $1 million each year in its harvest operations.

When ready for harvest, sugar cane is first set on fire deliberately and the remains are then gathered and hauled to the mill. Tactical procedures for burning a particular field depend heavily on wind direction and speed. Burning also must abide by State and Federal air pollution regulations.

After burning, the sugar cane remains must be harvested within 24-36 hours to avoid spoilage. Any significant rainfall during this critical period interferes with the movement of the heavy harvesting vehicles in and out of the fields. Rain also hastens the deterioration of the burned cane.

In a typical harvesting operation, 50 to 100 acres of sugar cane are burned at one time, leaving about $350,000 worth of burned cane lying on the field at the mercy of the weather.

Before 1960, cotton farmers in the Mississippi Delta region of the United States planted their seed as early in the spring as possible. If a cold snap wiped out the seed, the farmers replanted—often several times—until a crop emerged. Seed, fertilizer, and labor costs were a comparitively small investment.

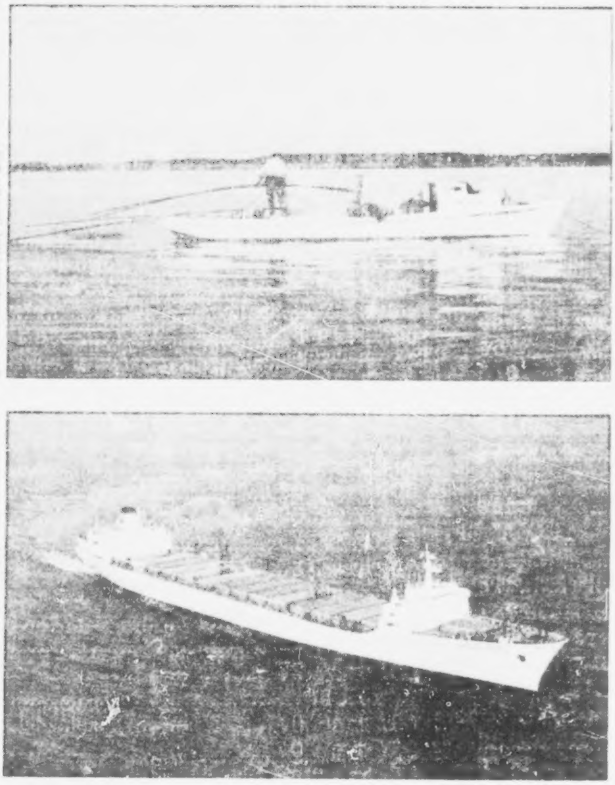
When the use of complex machinery replaced hand labor for cotton production in the early 1960's, costs increased dramatically and the weather factor could no longer be ignored. It became necessary to schedule cotton planting more efficiently through application of a combination of climatological, current observations, and weather forecast information.

Today, information on the soil temperature and 5-day weather forecasts allows these farmers to plant their cotton seed with good assurance that it will emerge the first time. The estimated savings for the cotton growers in southeast Missouri alone was about $1 million in 1970.

Accurate information on the relative humidity at harvest time also proved valuable to the cotton grower—about a $35 increase in value per bale. Using the Weather Service's humidity forecast, harvesting was restricted to lower humidity days because the cotton contained less moisture and won't deteriorate as quickly while baled and stored in wagons waiting for processing at the cotton gin.

Just as inland offices adapt forecasts to farmers and others in their region, the coastal Weather Service offices provide marine forecasts for the fishermen and others who make their living on the ocean. Accurate marine forecasts from these offices help the fishermen outmaneuver poor weather in protecting not only their lives and ships, but their valuable catch as well.

"There were over 1500 registered commercial fishing vessels of all sizes plying the New England waters in 1980. They caught 788 million pounds of fish of all types that



Mariners of all types, from the Chesapeake oyster dredger (top) to the skipper of a sleek container vessel, need the best weather information for safety and economy.

year, valued upon return to port at $327 million," said Patricia Kurkul, economist for NOAA's National Marine Fisheries Services at the Northeast Regional Headquarters in Gloucester, Mass.

The smaller New England fishing vessels depend upon the day's weather forecast received in port to decide whether or not to sail. Accurate forecasts allow them to gain the maximum number of fishing days.

"Often, the extra time at sea can mean the different between staying in business and going broke for some of the fishermen with small boats," said Duncan Amos, Commercial Fisheries Specialist at the University of Rhode Island.

The larger New England vessels travel to fishing grounds 200 miles off the coast and may remain at sea for up to 9 days. Generally, these fishermen will ride out rough weather on the fishing grounds.

The ideal situation for the larger vessels is to stay on the fishing grounds long enough to fill their holds and return to port without delay so that the fish will not deteriorate and diminish in value. Accurate weather forecasts help the vessel's captain to decide when to head for port without getting caught in a storm. Fighting headwinds can delay a vessel several days.

"Not only do the forecasts help these fishermen protect their valuable catch, but the weather reports also help them preserve their precious fuel," said Amos.

New England fishing vessels ranging in size from 50 to 200 tons use from 10 to 22 gallons of fuel an hour.

One significant measure of the value of accurate weather forecasts to the fisherman is the success of an expanding marine weather program in which the fishermen are volunteering to observe and report weather and sea state conditions to the National Weather Service.

"Thanks to the cooperation of the commercial fishermen, we are able to improve the quality of our forecasts to the mutual benefit of all concerned," said Paul Jacobs, Chief of the Marine Weather Services Branch at National Weather Service headquarters.

"The thousands of fishing vessels operating within the 200-mile fishing conservation zone along our coasts represents a wealth of previously untapped weather information," Jacobs added.

"In many places, fishermen are the only source of information. They see their participation as a self-help program. The payback is more reliable marine forecasts and greater responsiveness by the Weather Service to changing weather conditions. That means cost savings," Jacobs said.

To date, the Mariner Reporting or MAREP program covers the northern Gulf of Alaska and waters along the Aleutian Islands, the coastal waters of Washington and Oregon, and the southern New England fishing grounds 200 miles out to Georges Bank and as far south as Cape May, N.J.

Word of the success of the New England reporting program, established in August 1981, already is spreading. Fishermen in Maine are now interested in establishing a similar program in their area and efforts are underway to involve charter boats in South Carolina. Jacobs hopes that the MAREP program can be extended to all major fishing centers around the country.

Good weather forecasts are as valuable to the marine transporter as they are to the fisherman. The daily operating costs of a large vessel can run as high as $50,000 a day. Berthing space and stevedore services, costing many thousands of dollars, must be contracted in advance and paid whether used or not. Thus, immediate dollar savings can be realized by any marine forecast or weather warning that aids a vessel in reaching port on time.

Marine forecasts produced by the National Weather Service daily help the captains of ocean vessels make decisions involving costs. Waves of greater than 15 feet require a cargo ship at sea to reduce speed to prevent damage to the ship's hull or cargo. Based on the marine weather forecast, the ship's captain often must decide whether or not to circumnavigate a possible storm or to proceed on the most direct course and risk the consequences.

According to Dr. Richard E. Hallgren, Director of the National Weather Service, "good weather forecasts are inflation fighters whose value to many industries can be measured in terms of dollar savings."

"In a free market place, this usually means lower prices for the consumer," added Hallgren. ■

McROBERTS SALES CO., INC. P.O. BOX 486, RUSKIN, FLORIDA 33570 (813) 645-2561
TELEX 52-894

July 17, 1984

Honorable George Brown Jr.
House of Representatives
Washington, D.C. 20515

Dear Congressman Brown Jr:

I am Eugene McRoberts, President of McRoberts Sales Company Inc., P.O. Box 488, Ruskin, Florida. Our company is a member of the National Fisheries Institute, Southeastern Fisheries Association and the Gulf and South Atlantic Development Foundation.

I am writing to urge you to support H.R. 3255 which would include fish and fish products in the export promotion program of the Commodity Credit Corporation. This bill would help open up new overseas markets for the United States seafood industry and rectify a situation that was disasterous to my company 19 months ago when I exported a shipment of fish to Nigeria.

I have been in the fish and seafood business for over 50 years. My company exports and distributes over 50 different fish and seafood products. Several of the fisheries in the Gulf of Mexico have not been developed by our industry because they lack good markets here in the United States. Ladyfish, Crevalle Jacks and Little Tunny are examples. There is demand for these species, in several countries in Africa. January 7, 1983 I organized an effort to export $792 thousand dollars worth of Gulf of Mexico groundfish to Nigeria under an irrevocable letter of credit issued by United Bank of Africa. Federal guarantees were not available from either the Commodity Credit

(Specializing in Seafood)

JUL 23

McROBERTS SALES CO., INC. P.O. BOX 488, RUSKIN, FLORIDA 33570 (813) 645-2561
TELEX 52-894

Corporation or the Small Business Administration, and I got caught in the international monetary crisis in Nigeria. I have still not been paid for my shipment. The impact upon my company has been devastating.

H.R. 3255 should prevent this type of situation in the future. For this reason I urge you to support it.

Sincerely,

MCROBERTS SALES CO., INC.

Eugene McRoberts
President

EAM:ljm

cc: Congressman Jones
Congressman De La Garza
Congressman Breaux

(Specializing in Seafood)

NATIONAL FISHERIES INSTITUTE INC.
NATIONAL FROZEN FOOD ASSOCIATION INC
SOUTHEASTERN FISHERIES ASSOCIATION INC.

McROBERTS SALES CO., INC. P.O. BOX 488, RUSKIN, FLORIDA 33570 (813) 645-2561
TELEX 52-894

July 17, 1984

Honorable Don Bonker
House of Representatives
Washington, D.C. 20515

Dear Congressman Bonker:

I am Eugene McRoberts, President of McRoberts Sales Company Inc., P.O. Box 488, Ruskin, Florida. Our company is a member of the National Fisheries Institute, Southeastern Fisheries Association and the Gulf and South Atlantic Development Foundation.

I am writing to urge you to support H.R. 3255 which would include fish and fish products in the export promotion program of the Commodity Credit Corporation. This bill would help open up new overseas markets for the United States seafood industry and rectify a situation that was disasterous to my company 19 months ago when I exported a shipment of fish to Nigeria.

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(Specializing in Seafood)

NATIONAL FROZEN FOOD ASSOCIATION INC.

McROBERTS SALES CO., INC. P.O. BOX 488, RUSKIN, FLORIDA 33570
(813) 645-2561
TELEX 52-894

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Sincerely,

MCROBERTS SALES CO., INC.

Eugene McRoberts
President

EAM:ljm

cc: Congressman Jones
Congressman De La Garza
Congressman Breaux

(Specializing in Seafood)

NATIONAL FISHERIES INSTITUTE
NATIONAL FROZEN FOOD ASSOCIATION INC
SOUTHEASTERN FISHERIES ASSOCIATION

ESTABLISHED IN 1918 AS A PUBLIC AGENCY

COACHELLA VALLEY WATER DISTRICT

POST OFFICE BOX 1058 • COACHELLA, CALIFORNIA 92236 • TELEPHONE (714) 398-2651

DIRECTORS
RAYMOND R. RUMMONDS, PRESIDENT
TELLIS CODEKAS, VICE PRESIDENT
JOHN P. POWELL
PAUL W. NICHOLS
STEVE D. BUXTON

OFFICERS
LOWELL O. WEEKS, GENERAL MANAGER—CHIEF ENGINEER
BERNARDINE SUTTON, SECRETARY
VICTOR B. HARDY, AUDITOR
REDWINE AND SHERRILL, ATTORNEYS

July 3, 1984

The Honorable George E. Brown Jr., Chairman
House Agriculture Committee Subcommittee on Department Operations
2256 House Office Building
Washington, D.C. 20515

Dear Mr. Brown:

Please include the following comments in the hearing record for the recent oversight hearings about national agriculture weather operations.

The National Weather Service's Fruit Frost Service has been extremely valuable to the operation of this district in several respects.

Our watermaster relies on National Weather Service meteorologist Carl Garczynski's long-range forecasts when ordering water. While our farmers order water one day in advace, we must submit our orders to Hoover Dam 10 days in advance. This makes knowledge of future weather conditions important in determining our water needs at time of delivery. Unanticipated rains, heat waves and frosts can mean we will either have to dump water or ration farmers. These actions are rarely necessary with the Frost Service available to us during winter months.

This district also serves as the regional flood control agency for much of Coachella Valley and we rely on Mr. Garczynski to provide us with early warnings of potential flood conditions.

The service is so important to us that we provide office space and support for the National Weather Service's operation in Coachella Valley, including providing maintenance of transmitting facilities for the area's 24-hour weather broadcasting station.

Coachella Valley is one of the richest agricultural regions, acre-for-acre, in the world. Last year the valley produced crops with a gross value of approximately $240 million. Only tourism rivals agriculture in contributing to the economy of the area. Accurate local weather forecasts are vital to both industries.

Because of the importance of the service, we have sought for many years to have it extended year-around instead of limiting it to the winter months. This is a service of value to all people, not just specific interest groups. As such, it should continue to be a federally-funded operation.

Thank you for the opportunity to provide this input.

Yours very truly,

Keith H Ainsworth

For Lowell O. Weeks
General Manager-Chief Engineer

Correspondence held in Committee files:

County of Sutter
Department of Agriculture
142 Garden Way
Yuba City, California 95991

S & J Ranch, Inc.
P. O. Box 3347
Pinedale, California 93650

County of Lake
Department of Food and Agriculture
883 Lakeport Boulevard
Lakeport, California 95453

W. Atlee Burpee Company
Floradale Farms
P. O. Box 546
Lompoc, California 93438

Gardner L. Hutchins, Chief Administrative Office
Stanislaus County
Stanislaus, California

Lowell O. Weeks
General Manager-Chief Engineer
P. O. Box 1058
Coachella, Calfironia 92236

Department of Food and Agriculture
State of California
2330 N Street
Sacramento, California 95814

Board of Supervisors
County of Merced
County Administration Building
2222 M Street
Merced, California

Cooperative Extension
University of California, Mendocino County
County Agricultural Center
579 Low Gap Road
Ukiah, California 95482

California Citrus Mutual
P. O. Box 687
1020 East Mineral King
Visalia, California 93279

Purdue University
Department of agronomy
Life Science Building
West Lafayette, Indiana 47907

Nurserymen's Exchange
475 Sixth Street
San Francisco, California 94103

National Arborist Association, Inc.
1400 Wantagh Avenue, Suite 207
Wantagh, New York 11793

Ohio Agricultural Research and
Development Center
The Ohio State University
Wooster, Ohio 44691

Tennessee Nurserymen's Association, Inc.
P. O. Box 57
McMinnville, Tennessee 37110

Florida Fruit and Vegetable Association
c/o Scott, Harrison & McLeod
2501 M Street, N.W.
Washington, D. C. 20037

Brokaw Nursery, Inc.
P. O. Box 4818
Saticoy, California 93004

The Christian Brothers
Mont La Salle Vineyards
P. O. Box 420
Napa, California 94559

Agricultural Extension
University of California
Sutter and Yuba Counties
142A Garden Highway
P. O. Box 628
Yuba City, California 95991

J. C. Tobias & Son
251 South Saticoy Avenue
Ventura, California 93004

Marvin H. Martin
2401 West Third Street
Madera, California 93637

Ohio Farm Bureau Federation, Inc.
35 East Chestnut Street
P. O. Box 479
Columbus, Ohio 43216

Cooperative Extension
University of California
Napa County
1436 Polk Street
Napa, California 94559

Jene S. Hamilton
304 Beach Drive
San Clemente, California 92672

Koyama Farms
P. O. Box 726
Guadalupe, California 93434

A. J. F. Clement
Route 1, Box 116
McFarland, California 93250

Dr. Lewis G. Carpenter, Jr.
701 Crystal Springs Road
St. Helene, California 94574

Blackwell Land Company, Inc.
P. O. Box 2393
Bakersfield, California 93303

Orange County
Farm Bureau Inc.
14000 Myford Road
Irvine, California 92714

Lyn-De Farms, Inc.
P. O. Drawer 1119
Blythe, California 92226

Horrman, Vance and Worthington
1000 South Seaward Avenue
Ventura, California 93001

Agricultural Weather Committee
Hood River Grower
Shipper Association P. O. Box 180
Hood River, Oregon 97031

Gless Ranch
Ranch Market
19985 Van Buren
Woodcrest, California